EVALUATION OF THE ROLE OF DR. JOSHI'S FIXATOR IN HAND AND FOOT DEFORMITIES

THESIS

FOR

MASTER OF SURGERY

BUNDELKHAND UNIVERSITY

JHANSI

1999 Sourav Shukla

CERTIFICATE

This is to certify that the work entitled " EVALUATION OF THE ROLE OF DR. JOSHI'S FIXATOR IN HAND AND FOOT DEFORMITIES " which is being submitted as a thesis for M.S.(Orthopaedics) Examination ,1999, Bundelkhand University , Jhansi , has been carried out by Dr. Sourav Shukla in the department of Orthopaedics , M.L.B. Medical College , Hospital , Jhansi , under my guidance

The techniques embodied in this thesis were undertaken by the candidate himself and observation recorded were checked by me from time to time.

He has put necessary stay in the department as per university regulations.

GUIDE

Prof. P.K.DABRAL
M.S
Head
Department of Orthopaedics
M.L.B. Medical College , Jhansi

Dated 9/12/98

ACKNOWLEDGEMENT

" The words are few when the heart is full of gratitude " At this moment words seem to be inadequate to express my deep gratitude and regards towards my esteemed teacher , guide , and head of ortho. department , Prof. P.K. Dabral M.S. (Ortho.). I consider it a privilege to work under him . It is only his blessings, master guidance and valuable criticism which has encouraged me in completing this study.

I shall be failing in my duties if I don't acknowledge with gratitute the help and blessings Dr. R.P. Tripathi , M.S. (Ortho.) M.A.G.S. Assoc. Prof. Department of Orthopaedics , has bestowed upon me . His constant encouragement and active help has greatly eased my path.

I also express my humble thanks to Dr. D.K. Gupta , M.S. (Ortho) Asstt. Prof. Department of Orthopaedics . His constant encouragement , constructive criticism and innovative ideas helped me to complete this study.

I am indebted to the patients who inspite of their sufferings and economical restrain extended their co-operation and deserve special thanks.

I am very thankfull to my seniors , my batch mates and juniors who helped me to achieve my goals . I convey my special thanks to Dr. S.S.Rawat for his untiring co-operation.

I would like to thank Mr. Prabhat Saxena for the pains taken by him in typing this Manuscript.

Last but not the least I offer my sincere thanks to my parents Prof. R.K. Shukla and Mrs. Aloka Shukla for being my source of encouragement. I am greatfull to words my wife Himani for bearing with me the pains to complete this thesis . My friends Dr. Kapil Paliwal , M.S. (Optho.) and my sister Ruchi also played important roles in completion of this work.

SOURAV SHUKLA

/';[p-0

CONTENTS

INTRODUCTION

INTRODUCTION

The word "deformity" is coined from the word deformed i.e. any unacceptable deviation from the normal function and stucture is known as deformity. In fact the term ORTHOPAEDICS owns its origin to the Greek words opθs (Straight) and Παis (Child) or in the other words, a child free from deformity. It was originally applied to the art of correcting deformities by Nicoles Andry, a French physician who in 1741 published a book entitled " Orthopaedia: or the art of correcting and preventing deformities in children " In Andry 's time orthopaedic surgery in the form today did not exist. The art of correcting deformity and healing bone injuries which for many years run in the families of bone setters was gradually given a scientific outlook. In Great Britain,many of the fundamental principles of orthopaedics had been propounded, just before the twentieth century began by Hugh Owen Thomas (1834-1891) of Liverpool and Sir Robert Jones (1857-1933).

Deformity of a functional unit of the body does not merely effect the affected part but has a profound effect on the function of the body itself. Idiopathic progressive scoliosis not only leads the cardio-pulmonary compromise but also, lower marriage rate, higher divorce rate and suicidal rate. Deformities like hemi-hypertrophy of a limb are associated with liver neoplasma and Wilm's tumor. In an interesting study Klaus and Kennel have described the first few hours after the birth of a child as critical for the development of a parent child bond. It has both physical and mental component and occurs in an orderly sequence. If this is disturbed, the consequences may be far reaching not only on the relationship between the parent and child but upon the physical development of the child itself.

Deformities may be congenital or acquired and they may reflect an underlying abnormality of bone, joint or soft tissue. Congenital deformities, by definition, are attributable to faulty development and are present at birth, though they may not be recognised till date.

An abnormality of development may be caused by :
1. Genetic abnormality, 2. Environmental abnormality,
3. Combined genetic and environmental abnormalities.

Some of the better known anomalies are :- Congenital dislocation Hip, congenital club foot, syndectyly in hand etc.

Acquired deformities may be classified into two groups : Those which arise at the joint, and those in which it arise from the bone.

Deformity may be said to exist at a joint when the joint can not be placed voluntarily in the neutral anatomical position. The causes may be summarised under following headings.

1) Dislocation or subluxation, 2) Muscle imbalance, 3) Tethering or contraction of muscles or tendons, 4) Contractures of soft tissue, 5) Posture, 6) Arthritis, 7) Unknown causes,

Deformities exists in a bone when it is out of its normal anatomical alignment. The causes are

1) Fracture, 2) Bending, 3) Uneven epiphyseal growth.

Of these, fracture is by far the most common cause, e.g. Genu valgum (knock knee) that is often the consequence of compression fracture of lateral condyle of tibia, cubitus valgus due to displaced fracture of lateral condyle humerus.

As per the treatment of deformities, each case must be considered as an individual problem. Many do not require treatment or are not amenable to it. In appropriate cases one or more of the following methods may be used -

1) Manipulative correction and retention in plaster or splint.
2) Gradual correction by prolonged traction,
3) Division or Excision of contracted or the tethered soft tissue,
4) Osteotomy or osteoclasis,
5) Athrodesis,
6) Selective retardation of epiphysial growth (in children) .

Also one should keep in mind that the treatment should be-

- Economical,
- Expedient, and with
- Excellent functional results.

As we all know, the hand is a highly sensitive prehensile organ in which stability & great strength are provided within a very small volume. The mobility of hand is made possible by slinging its radial and ulnar border from a central fixed pillar i.e. the second & third metacarpals which are firmly anchored to the

carpal bone.

When a long bone of hand is fractured, the power of tendon is altered, therefore, the longitudinal arch of the hand is destroyed and deformity results. Deformity of minor degree in the long bones of arm & fore-arm usually have little effect on functions but within the hand, relatively minor degree of deformity may produce significant disturbance of function.

The importance of normally functioning hand needs no emphasis whether in earning a living, practising a hobby or allowing independence in daily activities.

Injury and disease therefore does much more than interference with grip or touch, it attacks the personality itself. No matter how trivial a wound of the hand may be seen, it is an economical disaster to its owner if it prevents his immediate return to work. The length of time away from work is almost directly related to skill and care provided during the primary treatment.

To talk about the deformity of foot, probably the most important from the prognostic view point are the patients with club foot.

The significance of club foot are manifolds-

1. It is a common deformity, the incidence being one in every 1000 birth.
2. It is easily diagnosed at the time of birth.
3. Amenable to treatment at various stages.
4. If neglected would lead to severe deformity, both functional and cosmetic.

Prof. Gavrill A.Ilizarov devised ring external fixators for correction of deformities by fractional distraction,

Dr. B.B. Joshi also devised fixators for correcting deformity by controlled differential fractional distraction.

The principle is gradual sequential stretching of the soft tissues. Joshi advocates that this being a semi-invasive method,it should be tried before the formal surgical release in all the cases.

To evaluate role of Johsi's external stabilizing system in correction of deformities of hand and foot, we have undertaken this study.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The human body is an amalgamation of many fundamental units put together. Among these units hand and foot have a distinct and a very important role.The functions of these can not be over emphasized.

DEFORMITIES OF FOOT:

The human foot has become greatly specialised for performance of two divergent functions. Both these functions are dynamic.

1. In standing it must provide a stable support for body weight— balance— a passive function.
2. In walking it must, in addtion to supporting the body weight, provide a resilient spring or lever by which the body weight can be propelled forwards- propulsion - an active function.

These objectives are fulfilled by the architectural arrangments of a number of small spongy elastic bones grouped together in the form of series of arches, for each of the functions muscle contractions are essential, their importance being greater in propulsions than in balancing.

Most of our knowledge of medicine and surgery practiced in old time is derived form Egypt.The earliest documentation of foot disorder comes in form of wall painting and preserved writing on the mummies. Paintings on the walls of the ancient tombs depict child with a clubfoot deformity and a statue of diastrophic dwarf with a clubfoot can be found in the TUTAN KHAMEN collection.

Common foot deformites include Hallux valgus,Hallux varus, Hallux rigidis , Cock up deformities (i.e.) flexion of I.P. joint and extension of Metatarsophalan geal joint , Hammer toe, Congenital metatarsal varus & Club foot.

Hallus valgus consists of abnormal adduction of the proximal phalanx of the great toe towards the midline of the foot and is associated, expecially in most extreme form with varying degrees of varus of the Ist metatarsal LAPIDUS (1934) suggested the form " Metatarsus Varus Primus" to indicate a primary developmental type of entity. LAKE (1942) considered varus deviation of the metatarsal as the most important factor. KAPLAN (1951) discribed a strong connection band extending form the tendon of Tibialis posterior muscle into the

Flexor hallucis brevis and Adductor hallucis and regarded this a contributing factor. Treatment as conservative consists of property well fitting shoe. Operative treatment consist of McBride operation, Mitchell's Metatarsel osteotomy (1958), Keller's arthroplasty, Ross -Smith arthrodesis et al (1952) of Metatarsophalangeal joint.

Pes cavus or the claw foot consists of clawing of the toes combined with a raising long arch of foot. Jones and Lovett reported cause of claw foot due to polio and inflammatary infections. Duchenne originally suggested that it was due to the weakness of the short muscles of the big toe and Interossei . Bre werton et al (1962) in a review of 629 cases of claw foot found that 25% of them had some degree of neurological involvement. Scarpyener (1945) reported congenital stricture of spinal canal. Giannestras (1953) reported right equino cavo varus foot due to intrathecal traction. Treatment includes both conservative and operative. Conservative tretment allow the re-education of the small muscle function by intrinsic exercise. Operative treatment include Lambrinudi Operation.(1927), Girdle stone tendon transfer operation (Tayler 1951), Japas mid tarsal V osteotomy with Steindler's striping of planter fascia.

CTEV / CLUB FOOT -

Archeological investigators in Mexico revealed that Aztecs recognised club-foot treating it with splints made of cactus leaves.

Hippocrates first described club foot deformity around 300 BC. He emphasized early and gentle treatment.The treatment consisted of "moulding of foot with piece of wax, applying resinous cerates with numerous bandages. In this process one should bring the parts into their true natural position, both, that are twisted and those that are abnormally contracted, adjusting them in this way by both the hands and by bandaging in like manner, so as to draw them into position gently and not violently" (Translation by Withington, 1927).

A club-foot deformity may also be acquired after birth secondary to muscle imbalance as in cerebral palsy, muscular dystrophy or poliomyelits. Example of this is seen in the famous painting by Spanish artist Ribera (1588-1659), "Pie bot" which is hanging in the Louvre Museum, the subject is a body with right sided hemiplegia with Talipes Equinovarus deformity obviously a victim of cerebral palsy.

In the middle of the 17th century, Arcaeus, Pare, Fabrig recommended repeated stretching by the use of mechanical corrective apparatuses, which gradually eliminated the deformity with a turn-buckle.

In the 18th century, Cheselden of England utilized repeated stretching and bandaging to maintain the correction. The bandage was of " several pieces of linen rag dipped in a mixture of whites of egg and flour ".

Scarpa in 1803 described the pathologic anatomy in 'A memoir on the congenital talipes equinovarus in children. In this treatise he described the deformity as a 'twisting of the scaphoid, os calcis and cuboid around the astragalus, Calling it a" congenital dislocation of the astragalo-calcaneoscaphoid complex". Scarpa also described the contractures of the soft parts and devised an apparatus with springs in a attempt to stretch the contractures and reduced the scaphoid.Subcutneous tenotomy of the Achilles tendon was first performed by Lorenz in Frankfurt in 1782. Delpech of France in 1823 reported the same technique in few patients with acquired talipes equinovarus.

In the beginning of 19th century 1802 Heymanlion published ' a complete treatise on spinae pedum' The first book on the foot affection that represented the original efforts in this field.

Little published paper 'A treatise on nature of club-foot ' in 1893. He was Englishman and had attack of polio at the age of 4 year and left leg was paralysed which later resulted into Talipes Equino-varus deformity. He went to Germany in 1835 having read the work of Stromeyer. He went to Hanover where Stromeyer performed subcutaneous tenotomy and corrected his deformity.During his convalescence, Stromeyer taught him how to perform this operation.Later on Little studied club foot in Germany and presented a thesis for which he was awarded Doctor of Medicine in Berlin. After this he returned to London and performed his first operation on February 20,1837. Later on he devoted all his life to the care of crippled. He also noticed a case of pseudomuscular atrophy and read paper before Obstetrical Society of London , entitled 'on influence of abnormal parturition, difficult labour, premature birth and asphyxia neonatorum on the mental and physical condition of child specially in relation to deformity ' Later on above condition with cerebral palsy was called as Little disease. Later on he found a hospital which is now called as Royal Nation Orthopaedic Hospital.

Guerin in 1838 appears to have been the first to report the use of plaster of Paris in the treatment of club foot.

In 1857, Solly performed one of the first bony operations for club foot- removal of part of the cuboid which was a precursor of the present day Dillwynn-Evans operation.

In 1866, Adams differentiated the acquired talipes equinovarus from the congenital variety. He also noted that the head and neck of the talus were deviated medially. He felt that this medial deviation of the talus was secondary adaptive change and not a primary defect, and stated " the altered or is adaptive rather than result of the defective power of development ".

Lund performed the first recorded talectomy for club foot in 1872. During the later part of the 19th century, Hugh Thomas (of Thomas splint fame and an uncle of Sir Robert Jones) devised the Thomas wrench, which was used to forcibly manipulate and correct the deformity.After the manipulation, a splint was applied to hold the correction. This method was used either along with or following surgery.

Except for tenotomy of the Achilles tendon, the operative treatment of the club foot began in 1867 with Lister's introduction of aseptic technique and the discovery of anaesthesia. These landmark discoveries, alongwith the introduction of the Esmarch Tourniquet in 1873, which permitted bloodless surgery, increased interest in the surgical approach.The introduction of pneumatic tourniquet by Cushing, in 1904 reduced the danger of tourniquet palsies and made surgery of the extremity less hazardous and more popular.

In 1890 Phelps, an orthopaedist in New York city described a one stage medial-plantar soft tissue release with lengthening of the tendon. He also did an osteotomy of the neck of the talus with wedge resection of the calcaneum.

In 1898, Walshingham and Hughes renewed interest in the theory that the deformity was due to a germ defect of the head of the talus. They along with others, reported osteotomy of the talus as means of correction, years later Elmslie in 1920 and Denis Browne in 1937 once again recommended osteotomy of the neck of the talus to correct the deformity.

In 1906, Codvilla from Italy described a soft tissue release with lenghening of the tendons, including the Anterior tibialis. Codvilla made plea for soft tissue surgery to be done when a child is about three years of age.This plea was made at a time when the prevalent methods of treatment were exocohleation bony operations of the calcaneous and cuboid.

From 1900 to 1930 many varied operations were recommended for the surgical corretion of club foot. In addition, during this period considerable progress was made in our knowledge of the pathologic anatomy of this deformity.

In 1930, Kite popularize non-operative treatment with serial manipulations and plaster cast immobilization. Kite was a great advocate of non-operative treatment and stressed the need for gentle manipulations.

In this class monograph in 1930, Brockman described the morbid anatomy of club foot as a congenital atresia of the astragalo-calcaneo-scaphoid joint. He also described a two stage soft tissue release for correction .

In 1934 Denis Browne renewed interest in mechanical intra-uterine pressure as cause of the deformity. He advised forceful manipulations before the application of his Denis Browne splint. Forceful manipulations have since fallen into disrepute because this method caused deformity of the bone and stiffness of the joint.

It is well known that continuous traction will gradually tire out a muscle; that a contracted muscle put on stretch will gradually lengthen and that a stretched muscle if relaxed, will shorten so that it can get back to position in which contraction can occur.

This principle of continuous traction has been applied to problem of CTEV in following manner :

Leo Mayer (1934) assessed that equinus position of Os calcis is extremely difficult to correct. This difficulty is due to inadequate methods hitherto available of gripping the os calcis and pulling down the posterior tubercle. Upward pressure against sole of the foot instead of correcting the deformity adds to it by creating a rocker bottom sole with calcaneocuboid joint at most dependent portion . For this

stubborn resistant type of deformity he devised a method which consisted of inserting of a nail or wire through posterior portion of os calcis by means of which, following tenotomy and posterior capsulotomy, the posterior portion of os calcis can be pulled downwards and anterior portion upwards. A six weeks period of immobilization was employed.

Lloyd T. Brown in 1936 devised an aluminium foot plate. It has been found possible and simple to obtain marked over correction of all the deformities of club feet by the use of continuous slight traction by means of elastic bands applied with this aluminium foot plate.

John F.Bell and David S. Grice (1944) observed that not only was internal torsion corrected but,the forceful and persistant kicking permitted by Denis Browne apparatus provided constant manipulation of the feet and opportunity for development of normal musculature.Thus was obtained a foot which was very flexible and was maintained in normal plane of external rotation.

Shin Movita and Kyoto in 1962 devised a method for treatment of resistant club foot deformities in children upto six years age.After heel-cord lengthening, occasionally combined with posterior capsulotomy, leverage wire traction is applied directly to calcaneous by means of Kirschner wire and padded foot plate, both of which are incorporated in plaster cast between manipulation. After correction of equinus and varus deformities of the heel, the wire is removed and subsequent correction is completed by manipulation and plaster casts.

Satisfactory immediate correction was obtained in fourty eight of fifty two feet in children ranging in age from four months to more than six years.

Prof. Gavrill Abramovich devised an external fixator in 1951 in Russia. This remained concealed from the rest the rest of world for a long time but has gained considerable acceptance and popularity during past ten year.He advocated the use of ring fixator in correction of the deformity in congenital talipes equino varus. By applying the fixator, not only the bone but also the muscles, nerves,blood vessels, and tissues grow simultaneously.

Grill & Franke (1987) attached much importance of the discrepancy in length between the medial and lateral border of foot in correction of the deformity and

achieved continuous distraction by using external fixator.Ten feet in 9 children were treated with age range from 8 to 15 years. In no patient the treatment was discotinued though five patients had temporary pain in matatarsal region and temporary oedema in the foot. No skin necrosis or sensory or motor disturbance in foot was seen. A plantigrade foot was achieved in all patients with satisfactory raidiographic appearance.All feet showed stiffness of subtalar joint and average range of movement at the ankle was 20 degree. The only complications were minor ones such as pintrack infections which settled with local treatment and increasing the tension in the wires. There were no instances of osteomyelitis.Five children required additional operations. Patients were satisfied with their result and were for the first time,able to wear ready made shoes.

Grill (1990) presented results of 20 feet in 18 children ranging in age from 8 to 16 , all having severe deformities. Thirteen children had neglected or relapsed congenital talipes equinovarus. The mean follow-up was seven and a half years, ranging from 12 months to nine years. In only two patients the treatment had to be discontinued because of pain and very severe lympoedema in the fore-foot. A plantigrade foot with a satisfactory radiographic appearence was achieved in all but three patients.

Cantin et al (1990) presented management of relapsed club foot and other severe foot deformities with the Ilizarov external fixator. He reported its use on 14 feet in 13 children aged two to 16 years. It included eight idiopathic relapsed club foot and six severely deformed feet secondary to teratogenic or neurological anamolies. A mean follow-up of 9 month was recorded. Plantigrade and functional foot was obtained in all of idiopathic club feet and in two of the teratogenic deformed feet.

Joshi et al (1990) presented a method of treatment based on use of external fixator in combination with controlled distraction of soft tissues for realignement of skeleton of foot in talipes equinovarus. This process of differential distraction corrects the deformity and all the same time keeps the joint surfaces apart, thereby avoiding any crushing force on bone or cartilage. By this fixator, not only the bone but also the muscles, nerve, blood vessels and tissues grow simultaneously. Also this being a semi-invasive procedure, does not require bony and soft tissue resection, corrects the deformity, gains foot length, improve mobility and streches

soft tissue contractures.If less than complete correction is achieved then this procedure may be followed by soft tissue release or bony resection. The medial border of the foot is distracted at the rate of 1.0 mm per day while the lateral border is distracted at the rate of 0.5mm per day, thus preventing crushing of the cartilages of the bones of lateral border due to wedging effect. Threaded rods between the tibial and the calcaneal pins allow corrections of equinus. Pressure over ankle is relieved by the rods by connecting the tibia to the fore foot.

Deformity of Hand

Hand, is a primary means through which human being physically interacts with the environment around them. In order to fulfil this crucial and varied role, the human hand has remarkable sensibility and adaptibility. These sensibilities are combined with a complex tool capable of performing a wide variety of coordinated motions and tasks with precision , speed and strength.

Because of the resultant diversity of functions, the hands are used in nearly all physical tasks. Further, because of the dependance on our hands for both proprioception and physical interaction, any condition whcih effect the hand will have a profound effect not only on the functions but in the overall personality

As we know human being carries out his profession and daily activities with the help of this efficient tool of nature. Even in minute disturbances he is liable to suffer not only economically but also emotionally, e.g. a painter who has lost his functions of hand due to some cause may not only loose his source of income but will also make him an emotionl wreck.

HAND INJURY

Fractures of hand are the most frequent of all fractures. These fractures frequently involve more than one bone of hand and have intra-articular extension, may be associated with dislocation and usually involve the soft tissues extensively. In most of these cases, conservative treatment with plaster leads to malunited fractures, unreduced dislocation and poor soft tissue care. Intramedullary fixation may lead to rotational instability, telescopy and poor fixation. External fixator at the same time achieves and maintain accurate alignment, permits soft tissue

care, spares the proximal joints & causes least periosteal stripping.At present external fixation is a universally accepted technique for the treatment of fractures or dislocations of hand for prevention of subsequent deformities.

Earllier methods of external fixation in hand injuries included pin anchored in acrylic frame & the small Roger Anderson metallic frame. These methods were simple to apply but did not have stability & modularity. Henry Jecqnet (1976) was the first person who developed fixation with a mini external (exo skeletal) fixator for skeletal & soft tissue support in severe hand injuries.

Schuned F, Donker, Wolcke, M,Burny,F.(1984) used external mini fixation in the treatment of 63 closed diaphyseal metacarpal fractures. A simple half frame configuration was applied in all the cases and open reduction was performed in 26% The mean duration of external fixation was 30 days. There were no cases of non -union & anatomical reduction was obtained in 86.6% of cases. There was no case of reflex sympathetic dystrophty. The general functional results were very good or good in 96.6% & open reduction did not significantly altered the final result.They inferred that for treatment of metacarpal fractures closed reduction or open reduction along with stabilization by an external fixator is a fairly useful alternative.Fgebryest,Rosenberg, Mosbe Koni (1986) used a simple and easily available low cost external fixation device made of two parallel plastic tubes and transverse Kirschner wire for finger reconstruction. They found this fixator assembly using the plastic tubes especially useful in comminuted, unstable fractures and dislocations of fingers associated with extensive soft tissue injury in the absence of other commercially available external fixators.

Dr.B.B. Joshi of Bombay, India (1988) developed a simple light external fixator system for use in fractures of hand. It came to be known as J.E.S.S (Joshi's external stabilisation system) . Dr.Joshi used this external fixator system in more than 150 cases of crush injuries of hand involving soft tissues & bones in varying degrees of severity. He found this assembly to be very effective in stabilising the skeleton in functional position to allow soft tissue assessment & subsequently soft tissue healing .This system helps in tissue stabilisation , spontaneous revascularisation & tissue expression by gradual & controlled distraction.

Sameer, I Shehadi (1961) used closed reduction & external fixation of difficult hand injuries. In this study they excluded patients with fractures of distal

phalanx, undisplaced & stable fractures & those displaced fractures in which a stable closed reduction could be achieved.The Kirschner wire were introduced transversely at a 90 degree angle to the long axis of the bone,one at the midlateral level and the second about 2 mm dorsal to the first.The Kirschner wire were then fixed externally with methylmethacrylate rods (which were made by introducing the soft methylmethacrylate inside clear plastic tubes slit open on one side.The open side of the tube was then applied against the free ends of Kirschner wires & allowed to set in 5 to 10 mins.) thus stabillising the fracture. They utilised the plastic tubes used for packing the Kirschner wires for this purpose.They had conducted their study on 26 patients with 30 hand fractures (19 metacarpals & 11 phalangeal) treated by closed reductions & external fixation. The percentage return of total range of motion in phalangeal fractures varies from 66 percent to 98% (mean 84%).

Buchlar et al (1991) : In managing the fractures & dislocation of first metacarpal the external fixation provides stable reduction and functional positioning.He showed that in 20 displaced comminuted fractures of thumb (Carpo Metacarpal) joint which were treated by external fixation, 75% of patients had very good result after follow up of three years. As compared with the uninvolved side, axial rotation averaged 79%,radial abduction 89%, key pinch 88% grip strength 81%.

Asmead,D.Roth et al (1992) used external fixation not only for the skeletal stabilization but also for the management of soft tissues in twenty nine cases of acute hand injuries.

Parson, S.W. Fitzgereld ja, Shearer (1992) treated complex metacarpal & phalangeal fractures by Shearer micro external fixator.This fixator consist of unpolished stainless steel rods which may be used singly or linked by an articulating central block. The fracture may be first reduced and the fixed externally or the fixator can be applied with two rods and central block They had carried out their study in 30 patients with 37 unstable or complex matacarpal or phalangeal fractures. In one & half year of follow up there was minimal soft tissue tethering thus allowing early joint mobilization with good or excellent function .Due to well recongnised delay in appearance of radio- opaque callus, the fixator was removed when union was clinically rather than radiologically evident.

Steeley, A. Cooney et al (1992) applied external fixator in 33 injuries of the

upper extremity. Ten fractures of hand, 22 Colles' fracture & one in osteotomy for Madelung's deformity. In 19 patients external fixation was primary and in 14 patients it was following failure of another type of fixation (cast or K-wire).

All ten fractures of the hand united in four to twelve weeks (average six weeks). In the two patient with proximal phalangeal fractures,external fixation resulted in bone union, after healing failed to occur with the fixation by crossed Kirschner wires. Range of motion after fracture union was 5 to 80° at the metacarpo phalangeal joint & 10 to 60° at proximal interphalangeal joint.In other patients, intra-articular fractures & tendon injuries associated with joint fusion resulted in limited joint motion. The incidence of complications in this series was 33% . There were four instances of infectionsat pin site.There was no case of ring seqestrum or osteomyelitis at the pin site. The external fixator for unstable fracture at the hand & wrist with bone or soft tissue loss provides rigid skeletal stabilization, adaptability of mini fixator frame provides for placement of pins in wide variety of angles and position, so that they do not interfere with soft tissue care or overall hand function.

MATERIAL AND METHODS

MATERIAL AND METHODS

This study has been conducted on the patients attending Orthopaedics Department, M.L.B. Medical college Hospital, Jhansi.

FOOT

CTEV

Criteria for selection of patient -

Cases of resistant, inadequately corrected or relapsed congenital talipes equinovarus in age group of 3 months to adult willing for correction of deformity by controlled,differential distraction with Joshi's talipes external fixator was selected for this study.

Pre-operative clinical and Radiological examination-

- Detailed general & systemic examination.
- Local examination.
    - . Calf : Girth & muscle tendon ratio
    - . Heal: Varus / Neutral / Valgus.
    - . Presence of abnormal skin : Medial plantar & posterior heel creases.
    - . Callosites
    - . Ankle movements
    - . Heel walk
    - . Measurement on podogram
    - . Medial border length : from medial aspect of heel to tip of great toe.
    - . Lateral border length : from lateral aspect of heel to tip of little toe.
    - . Heel to II toe length
    - . Radiological examination-
        - -Talo calcaneal angle (AP)
        - -Talo calcaneal angle (LAT)
        - -Talo calcaneal index (T.C.I.)
        - -Talo Istmetatarsal angle(AP)

Components

Three sets of assembly components are designed to suit the requirements for different age groups.

I) SMALL SET (Suitable for children upto 2 years)

1. Link joints	30
2. Connecting rods (2-5 mm)	
Straight Rods 4"	03
6"	02
8"	02
"Z" Rods	02
"L" Rods (large)	02
(small)	02
3. Distractors (4mm)	02
4"	02
6"	02
4. Foot plate	01
5. "K" wires	
2mm 6"	02
1.0 mm 6"	06

I I) MEDIUM SET (suitable for children between 2 to 5 years) .

1.Link joints 30	
2. Connecting Rods (3.0) -	
Straight Rods 5"	03
6"	02
10"	02
"Z" Rods	02
"L" Rods (large)	02
(Small)	02
3.Distractors (4 mm)	
4"	02
6"	02
4.Foot plate	01

5."K" wire (2.0 mm)

5"	03
6"	02

III) LARGE SET (Suitable for age 7 to adult) :

1. Clamps Aesculp type

	09
	12

2. Connecting Rods (4.0)

Straight Rods 6"	05
12"	02

3. Distractors (4mm)

6"	02
D.C Rods	02

4. "K" wires -

2.5 mm, 5"	05
2.0 mm, 6"	06

Other instruments required are Hand drill, Wire cutter, Allen key, T handle.

Assembly-

The basic assembly consists of three pin holds and three pairs of connections, on medial and lateral asipects of the limb.

(a) Pin Holds :

- Tibial pin hold,
- Calcaneal pin hold,
- Metatarsal pin hold,

(b) Connections :

- Tibio-calcaneal Distractors
- Tibio-metatarsal connecting rods
- Calcaneo-metatarsal Distractors

(c) Foot plate Attachment.

OPERATIVE TECHNIQUE :

The operation is performed under Ketamine with pneumatic tourniquet control (100-300 mm of Hg.)

1. Pin Insertion -

(a) Tibial pins : Two parallel transfixing pins are passed at the junction of the upper & middle third of the tibia, about one and half inches apart.

(b) Metatarsal pins : one transfixing pin is passed from the fifth to the first metatarsal at the level of neck or distal shaft. Two separate pins, one from medial & other from lateral aspects are inserted parallel to the transfixing pin, engaging three metatarsals on each side at least.

(c) Calcaneal pins : Two transfixing pins are passed in calcaneum parallel to each other in proximo-distal direction 10-12 mm apart. Posteriorly,another pin is passed along the axis of the calcaneum below the insertion of the tendo-achilles,mirroring the deformity.

2. Attachment of "Z" & "L" rods:

(a) Tibial attachment : The middle portion of the "Z" rods are attached by link joints to these pins, on medial and lateral aspects.The transfixing pins are pre-stressed for better hold while tightening the joints.

(b) Metatarsal attachment : Two small "L" rods are attached to the metatarsal pins on medial & lateral aspects of the foot with one limb projecting plantarwards, to provide connection for the foot plate attachment.

(c) Calcaneal attachment : Two large "L" rods are attached to the transfixing pins on either sides of the heel, in the same manner as described above.

3. Connecting the pin holds :

(a) Calcaneo-metatarsal connection : A pair of appropriate size distractors are attached to the calcaneal & metatarsal pins on either side of the foot.

(b) Tibio-calcaneal connection : The posterior limbs of the "Z" rods are attached to the "L" rods of the calcaneal assembly by another pair of distractors. The distractors are attached near the transfixing pins (lateral and medial aspects) of calcaneam.

(c) Tibio-metatarsal connection : The anterior limbs of the "Z" rods are connected by a pair of rods to one of the metatarsal pins on either side of the foot .

4. Stabilization of Assembly & Foot Plate Connection :

(a) Tibial Hold : The anterior & posterior parts of the "Z" rods are connected with transverse bars respectively.These transverse connections provide stability to the assembly against twisting forces & additional sites for link joints.

(b) Calcaneal Hold : The posterior limbs "L" rods & the axial calcaneal pin are connected together with a transverse rod to complete the calcaneal hold.

(c) Foot plate Attachment : The plantar limbs of the metatarsal & calcaneal "L" rods are attached respectively, with straight rods. This connection provides a slot for the transparent acrylic foot plate. This plate prevents the flexion contracture of the toes, which might occur due to tightening of the flexors, during the distraction phase. Both distractors may be distracted slightly.

This takes up to slack in the assembly & puts the soft tissue at the optimal stretch.Care should be taken to prevent skin necrosis and there should be no blanching at the skin. Multiple dermal deep cuts are given on the medial side of the foot if the skin is under tension.

The pin sites are covered with dry gauze and the whole assembly is covered with gamgee roll & cardboard to prevent injury.

POST-OPERATIVE MANAGEMENT

Pin site care

The dressing are performed twice a week with savlon & hydrogen peroxide. Pin sites are covered with dry gauze & protective dressing is re-applied.

Distraction-

Functional distraction at the rate of 0.25 mm/6 hourly or less is the key to succes. Differential distraction with medial side at twice the rate of lateral is performed. The lateal aspect is distracted to prevent the crushing of articular cartilages.This method effectively elongates the otherwise shortened foot.

On the third post-operative day distraction is commenced as follows :

(a) The calcaneo -metatarsal distraction-

.Corrects forefoot adduction at Tarso-metatarsal joints

.Stretches the socket for the head of talus,

.Reduces the calcaneo- cuboid joint.

Medial..... 0.25 mm every 6 hours,

Lateral..... 0. 25 mm every 12 hours.

End point ..... . (clinical & radiological correction of forefoot adduction ,approx. 2-4 wks) .

(b) The tibio-calcaneal distraction is carried out in two positions on the calcaneal assembly.

i) Medial & lateral calcaneal bars

Distraction in this position corrects varus & Inversion of the hind foot.

Medial.....0.25 mm every 6 hours,

Lateral ..... 0.25 mm every 12 hours

End point ..... (judged clinically 7-10 days).

ii) Posterior calcaneal bar close to the axial pin.

Distraction in this position provides thrust force to stretch posterior structures & corrects hind foot equinus.

Both distractors..... 0.25 mm every 6 hours,

End point ..... assessed clinically and radiologically,approximately 2-3 weeks of distraction (end at 6th post-operative week) .

(c) The tibio-metatarsal connection-

☆ Static,provides tension force

☆ Keepsanterior part of ankle joint open, while the heel equinus is being corrected by thrust force.

☆ Reduce excessive tension by loosening and re-tightening the clamps once a week.

☆ Dorsiflexion of the ankle joint, performed gradually following hind foot correction.

☆ Alternative distraction technique may be used if the parents cannot be educated to perform distraction at home. The distraction is then performed in the OPD two to three times a week. The distractor screw is turned till resistance or pain is felt. The screw is unturned half a turn to relieve any excessive tension.

FOLLOW-UP SCHEDULE FOR CTEV

Patient's name

Age / Sex

Side : Unilateral (Right / Left) or Bilateral

Severity or deformity : Mobile / Rigid

Previous treatment : None / Stretching & serial casting / operative General & Systemic Examinations

- Position of heel
- Skin creases-
  - Medial planter
  - Posterior heel

Measurement on Podogram -

- Medial border
- Lateral border

X-rays -

- Talo calcaneal angle (AP)
- Talo calcaneal angle (Lat.)
- Talo calcaneal index
- Talo Ist Metatarsal angle.

Management -

- Joshi's talipes fixator for -
  - Distraction phase
  - Static phase

Post-operative management after fixator removal-

- Bk pop foot
- Walking shoes.

Post-operative assessment -

- Position of heel
- Ankle movements
- Gait
- Measurement on podogram -
  - Medial border ,
  - Lateral border

X-rays -

- Talo calcaneal angle (AP)
- Talo calcaneal angle (Lat.)
- Talo Ist Metatarsal angle.

Hospital for Joint Diseases Orthopaedic Institute functional rating system for club foot surgery.

Category			Points
1. Ankle dorsiflexion (passive motion) -			
more than	90		15
	90		5
less than	90		0
2. Subtalar joint motion (Passive motion) -			
more than	10		0
Less than	10		5
Stiff			0
3. Position of heel when standing -			
0-5 valgus			10
More than 5 valgus			5
Varus			0
4. Forefoot (Appearance)-			
Neutral			10
Less than 50 Adduction/ Abduction			5
More than 50 Adduction/ Abduction			0
5. Gait-			
Normal heel/Toe gait			10
Cannot heel walk			2
Cannot toe walk			2
Flat foot gait			4
6.Radiographic Measurement - (T-C index)			
40 or more			5
Less than 40			0

Talo - Ist metatarsal Angle-

10 or less	5
15 or more	10

7.Shoes -

Regular -No complaints	5
Regular with complaints	2
Orthopaedics shoes inserts,braces	0

8. Function -

No limit	15
occasionally limited	0
Usually limite	0

9.Pain-

Never	10
Occasionally	5
Usually	0

10.Flexor Tendons -

Full function	5
Partial function	3
No function	0

Excellent	:	85 - 100 points
Good	:	70-84 points
Fair	:	60-69 points
Poor	:	60 points

HAND INJURIES

CRITERIA FOR SELECTION OF PATIENT :

Patient of all age both male and female with open and closed fractures of hand were included in this series.

PRE-OPERATIVE ASSESSMENT :

. History about -

- Time ,place and mode of injury.

.General routine investigations

.Pre-oprative : X-ray of local part at least in two view :

Antero-posterior, 10-30 degree oblique or lateral view.

.Classsification of bony injuries -

A. 1.Simple,

2.Compound.

B. 1.Non-comminuted

2.comminuted

C. 1.Intra-articular,

2.Extra-articular.

TREATMENT PROTOCOL

.CONSENT OF THE PATIENT :

All the patients who were taken for surgery were told about the external fixators procedure to be done, the operative and post-operative complications and likely results.

ANAESTHESIA -

In most of the cases. fixators had been applied under regional anaesthesia combined with or without deep sedation.

.FIXATOR MATERIAL INCLUDE -

- Link joints
- K- wires 1.5mm, 2mm, 2.5mm, 3mm stainless steel 6"/9" long
-Side bars (connecting rods)
-Distractor

In our fixator system, we reduce the cost by following methods :

1. Sometimes not using stainless steel rods,
2.By re-utilizing the link joints.

INSTRUMENTATIONS

Instruments which were used are-

a. Hand Drill (Manual)
b. Pliers

c. Wire cutter
d. Allen Keys 2.5 mm and 3mm.

In closed hand injury the K-wires were passages through safe joints in the phalanges and the metacarpals depending upon the indication and JESS frames were constructed on them. 1.2 to 1.5 mm k-wires were used for phalanges while 2mm 2.5mm k-wires were used for metacarpals.

INSERTION OF KIRSCHNER WIRE -

- ☆ In the phalange fracture involving the mid shaft two k-wires used proximal and two distal to fracture site. K-wires were inserted dorsolaterally. The site of insertion was slightly dorsal to the junction of palmar thick and dorsal thin skin in order to avoid injury to digital vessels and nerves.

- ☆ The fractures of metacarpals were stabilized by 2 or 2.5 mm k-wires both proximal and distally and then stabilized on a metacarpal hold.

- ☆ When there were multiple fractures and dislocations rays of same hand then these were stabilized by constructing standard hand frame.

- ☆ In thumb fractures or Ist carpometacarpal fractures dislocation, position of thumb was maintained by stabilizing the Ist metacarpal by putting 2 lateral K-wires and one dorsolateral wire and then connecting them to the main assembly keeping the thumb in full extension, abduction and slight palmar rotation.
- ☆ In intra-articular fracture, the fracture joints was stabilized on bilateral frame across it.
- ☆ The vascularity of all fingers checked immediately after the application of JESS by watching the capillary filling or by pricking into the pulp of finger.

All wounds were dressed after cleaning. The pin tracks were cleaned by, rectified spirit.These were further covered by gauze pieces soaked in betadine solution.The pointed edges of wires were cut short and small rubber tubing was sleeved over them. The whole assembly was covered by cotton and bandages. Operating time varied from 45 to 120 minutes.

POST-OPERATIVE MANAGEMENT :

- ☆ Assessment of vascularity status,
- ☆ Analgesic and anti-inflammatory drugs,
- ☆ Antibiotics,According to pus culture and sensitivity in compond fracture or dislocation. In closed injury 5 days course of antibiotics is given.
- ☆ Limb elevation
- ☆ Active and passive finger movements.
- ☆ Check radiograph- Immediately after operation, at the time of removal of JESSof and one week after the end fixator removal.
- ☆ Local dressing of the wound and pin track dressing.

FOLLOW UP :

Patients were followed up at 2 weekly interval till 2 months after removal.

Main Aim of Follow-up :

-Assessment of functions,
-Stability of apparatus,
-Complication if any,
-Advice regarding physiotherapy,
-To see for union.

OBSERVATION

We dealt with in all seventeen cases of hand and foot deformities.

Of these eight cases were of Idiopathic, Congenital club foot deformity while nine cases were of hand fractures and injuries.

All the cases were treated by Joshi's External stabilizing system.

Table -1

Division of patients in terms of years

Age(yrs.)	Cases	%
0-3	3	37
3-7	3	37
7-11	2	26

Table -2

Division of patients in terms of sex

Sex	Cases	%
M	6	75
F	2	25

Table -3

Division of patients in terms of foot

Side	Feet	%
R	7	77
I	2	23

This present study comprised of eight patients with Nine feet of idiopathic, rigid, neglected, talipes equino varus deformity treated by controlled differencial fractrional technique. The right foot were more affected in our case study.

The distraction was carried out by self and then by parents and patients under guidance. The youngest patient was of eight months and the oldest was of eights years. Six were males and two were females. The deformity was bilateral in one case. All the feet except two were treated earlier and either failed or relapsed (Six in Number). Two Patients were treated by postero-medial soft tissue release while rest by serial mouldings and casting.

Table -4

Pre- operative readings

Sr. No.	Name	Side	Medial Border (cm)	Lateral Border (cm)	Difference (cm)
1.	Arti	R	7.8	8.2	-0.5
2.	Dinesh	R	7.5	7.8	-0.3
3.	Rajababu	L	7.8	8.1	-0.3
4.	Pankaj	R	11.0	11.5	-0.5
5.	Pushpendra (A)	R	7.6	8.5	-0.9
	(B)	L	7.5	9.5	-2.0
6.	Zishan	R	8.4	8.8	-0.4
7.	Laxmi	R	9.0	9.5	-0.5
8.	C.Mohan	R	9.5	10.0	-0.5
	MEAN				**-0.6**

Table -5

Post- operative readings

Sr. No.	Name	Side	Medial Border (cm)	Lateral Border (cm)	Difference (cm)
1.	Arti	R	10.7	9.5	+1.2
2.	Dinesh	R	11.7	10.6	+1.1
3.	Rajababu	L	13.5	11.7	+1.8
4.	Pankaj	R	14.7	14.0	+0.7
5.	Pushpendra (A)	R	16.2	14.3	+1.9
	(B)	L	15.5	14.2	+1.3
6.	Zishan	R	11.9	11.0	+0.9
7.	Laxmi	R	12.1	11.4	+1.7
8.	C.Mohan	R	11.1	10.4	+0.7
	MEAN				**+1.65**

The present study shows that pre-operatively the mean difference in between the medial border length and the lateral border length was -0.6cm. Post-operatively this mean difference shows significant improvement and it was +1.6cm. This indicates that there was restoration of medial border length towards normal.

Table -6

Pre- operative radiological assesment

Sr. No.	Name	Side	T.C.A. (Ap)in °	T.C.A. (Lat)in °	T.C.I. in °
1.	Arti	R	17	15	32
2.	Dinesh	R	14	10	24
3.	Rajababu	L	15	12	27
4.	Pankaj	R	22	12	34
5.	Pushpendra (A)	R	12	15	27
	(B)	L	14	11	25
6.	Zishan	R	16	13	29
7.	Laxmi	R	10	12	22
8.	C.Mohan	R	10	14	24
	MEAN		**15**	**13**	**28**

Table -7

Post- operative radiological assesment

Sr. No.	Name	Side	T.C.A. (Ap)in °	T.C.A. (Lat)in °	T.C.I. in °
1.	Arti	R	28	27	55
2.	Dinesh	R	24	20	44
3.	Rajababu	L	27	20	47
4.	Pankaj	R	34	22	56
5.	Pushpendra (A)	R	30	32	62
	(B)	L	28	25	53
6.	Zishan	R	30	28	58
7.	Laxmi	R	26	24	50
8.	C.Mohan	R	24	22	46
	MEAN		**28.5**	**28**	**46.5**

The present study shows that pre-operatively the T.C.A. (L) was 13°, T.C.A. (Ap) was 15° and T.C.I. was 28° while post-operatively the T.C.A. (AP) was 28.5°, T.C.A. (Ap) was 28° and T.C.I. was 46.5°.

It indicates that the normal TCA(L),TCA (AP) and TCI returns to normal.

Table -8

Talo- Metatarsal angle (pre and post- operative)

Sr. No.	Name	Side	Pre- operative in °	Post- operative in °
1.	Arti	R	22	2
2.	Dinesh	R	32	12
3.	Rajababu	L	18	15
4.	Pankaj	R	35	3
5.	Pushpendra (A)	R	38	3
	(B)	L	34	5
6.	Zishan	R	29	6
7.	Laxmi	R	28	2
8.	C.Mohan	R	32	8
	MEAN		**30**	**6.6**

The table shows that pre-operatively the Talo - Ist Metarsal angle was 30° while post-operatively it was 6.6° . This denotes that there was significant correction of Adduction deformity.

We have further noticed that two patients Dinesh and Raja Babu had some adduction deformity of the fore foot after six months of follow up. These patients after removal of frame did not properly follow the post operative progarmme. i.e. only one B/K POP Boot was given. They did not returen for follow up or orthotic shoe. Thus this showed that in maintenance of correction, B/K POP boot and orthotic plays a vital role .

Table -9

Pre-operative & Post- operative ankle dorsiflexion(Passive)

Sr. No.	Name	Side	Pre- operative ankle dorsiflexion	Post- operative ankle dorsiflexion
1.	Arti	R	0	15
2.	Dinesh	R	0	12
3.	Rajababu	L	0	12
4.	Pankaj	R	0	15
5.	Pushpendra (A)	R	0	15
	(B)	L	0	15
6.	Zishan	R	0	15
7.	Laxmi	R	0	15
8.	C.Mohan	R	0	12

DETAILS

Category	Points
Ankle dorsiflexion (more than 90°)	15
90°	5
(less than 90°)	0

This table shows significant improvement in ankle dorsiflexion which was not possible pre-operatively because the foot was fixed in equinus.

All patients had ankle dorsiflexion more than ninety degree of ankle. Patients could squat properly which was not possible before the correction of deformity

Table -10

Post- operative clinical assesment

Sr. No.	Name	Side	Position of heel on standing	Fore foot apperance
1.	Arti	R	N	N
2.	Dinesh	R	Varus	Add
3.	Rajababu	L	Valgus	Add
4.	Pankaj	R	Valgus	N
5.	Pushpendra (A)	R	Valgus	N
	(B)	L	Valgus	N
6.	Zishan	R	Valgus	N
7.	Laxmi	R	Valgus	N
8.	C.Mohan	R	Valgus	N

The present study shows that post-operatively seven heel were in valgus position, one was in varus while one heel was in neutral position. Similarily two fore feet appeared to be slightly adducted.

One feet was in varus position due to two reasons. Onedue to under correction and two due to lack of follow up B/K POP Boot and orthotic shoe. Rest all showed valgus heel upto 0-5°.

Table -11

Sr. No.	Name	Side	Distraction Phase (in wks)	Static Phase (in wks)	Removal (in of Fixator wks)
1.	Arti	R	5	5	10
2.	Dinesh	R	4	6	10
3.	Rajababu	L	5	6	11
4.	Pankaj	R	6	6	12
5.	Pushpendra (A)	R	14	6	20
	(B)	L	10	6	16
6.	Zishan	R	4	6	10
7.	Laxmi	R	5	6	11
8.	C.Mohan	R	5	6	11
	MEAN		**6**	**6**	**12**

In our study mena duration of fixator on distraction phase was 6 weeks and patients were put on static phase for mean of 6 weeks. All the patient were given below knee POP cast after removal of fixator.

Table -12
COMPLICATIONS

Sr. No.	Complications	Cases	Percent %
1.	Superficial pin track infection	4	44
2.	Flexion contracture of toes	2	22
3.	Linear skin nerosis	1	11
4.	Loosening of link joints	9	100
5.	Oedma	3	33

-- Superficial pin track infection developed in 44% of cases but no case of osteomyelitis developed.

-- Linear skin necrosis developed in one case which healed by regular dresing.

-- All the cases developed loosening of link joints which were corrected by weekly check up of the joints Post-operatively oedama in two cases which subsised in three days.

Table -1
(Age Distribution)

Age(yrs.)	Cases	%
10-15	1	11
15-20	2	23
20-25	-	-
25-30	-	-
30-35	3	33
> - 35	3	33
Total	9	100

This table shows that the population maximally affected was between the age groups > than 30 yrs.

Table -2
(Sex Distribution)

Sex	Cases	%
F	4	45
M	5	55
Total	9	100

In our study males (55%) were more affected.

Table -3
(Duration of injury)

Duration (days)	Cases	%
O	3	33
1-15	4	43
15-30	1	12
30-40	-	
40-60	-	
over 1 year	1	12

Table 3 shows a maximum (43%) of cases presented in the hospital with in 15 days followed by 33% on day O.

Table -4
(Mode of Injury)

Sr. No.	Mode of Injury	Cases	%
1.	Road side Accident	2	23
2.	Glass Injury	1	11
3.	Thresher	2	23
4.	Fall of Heavy object	3	32
5.	Punch	1	11
	Total	9	100

The most common mode of injury was fall of heavy object.

Table -5
Rays Involved

Rays	Cases	Rays	Cases
R_1	-	L_1	1
R_2	5	L_2	1
R_3	5	L_3	1
R_4	5	L_4	2
R_5	2	L_5	2

The most common ray involved in our study populetion is R_2,R_3, and R_4

Table -6
Joints Involved

Joint	1	2	3	4	5
MPJ	1	3	3	3	1
PIPJ	-	4	4	3	-
DIPJ	-	1	1	2	1

CMC Joint involvement -1
The most common joint involved in our study was the proximal interphalangeal joint of 2nd 3rd and 4th fingers.

Table -7

CONDITION OF INJURED PARTS

Sr. No.	CONDITION	Cases	%
1.	Flexion Contracture	1	11
2.	Crush Injuries	7	78
3.	Clean Incised Wound	1	11
	TOTAL	9	100

This table shows that the most common presentation at the time of admission was crush injury of the injured hand (78%)

Table -8

GRADES OF COMPOUND

GRADE	I	II	III
CASES	1	2	6

In out study the total cases of compound injury was 6 out of which maximum number of cases belong to Grade III

Table -9

JESS FRAMES

Sr. No.	TYPE	Cases	%
1.	Extended Hand Frame	2	22
2.	Hand Frame	3	34
3.	Distractors	2	22
4.	Thumb Rays Frame	1	11
5.	Thumb Web Maintenance Frame	1	11
	TOTAL	9	100

The most Common type of JESS used in our study population was hand frame (34%)

Table -10
Operation requried in management

Sr. No.	Operation	Cases
1.	Debridment (with external fixation)	6
2.	Distraction	3

In are study debriment and fixation were maximally done (6 in no.)

Table -11
Showing Wound Healing

Days	Cases	%
0-14	5	56
15-28	2	22
29-45	1	11
47-60	1	11
Total	9	100

This shows wound healing takes place maximally between 0-14 days.

Table -12
Complications

Sr. No.	Complications	Cases	%
1.	Pin Tract Infection	2	36
2.	Osteomyelitis	1	16
3.	Deformity	3	41
4.	Non Union	0	-
5.	Delayed Union	1	16

In our study at the time of removal of fixator some degree of deformity (41%) persisted due to stiffness.
Pin tract infection was seen in about 36%.

Table -13

Time of Fixator removal in days

Days	Cases	%
< 21	2	22
< 45	5	56
< 60	2	22
Total	9	100

Majority of fixator was removed within 45 days.

Table -14

Show in difference in active movement present at MP joint uninvolved and involved Ray at final follow up (in°)

Difference in movement (in°)	Cases	%
0	1	11
20	5	56
40	2	22
60	-	-
80	1	11
Total	9	100

Above table shows that about 56% of MP joints had difference of movement to about 20°.

Table -16

Difference in active movement at DIP as compared to uninvolved Ray (in°)

Difference in movement (in°)	Cases	%
0	2	22
20	5	56
40	2	22
60	-	-
Total	9	100

About 56% of the patients had different of movements of about 20°.

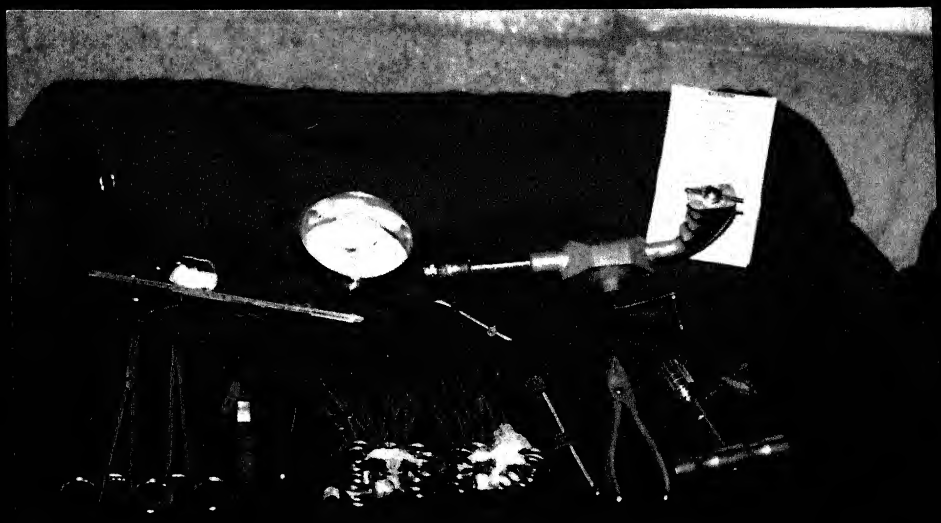
Table -15

Show in difference in active movement present at PIP as compared to uninvolved Ray (in°)

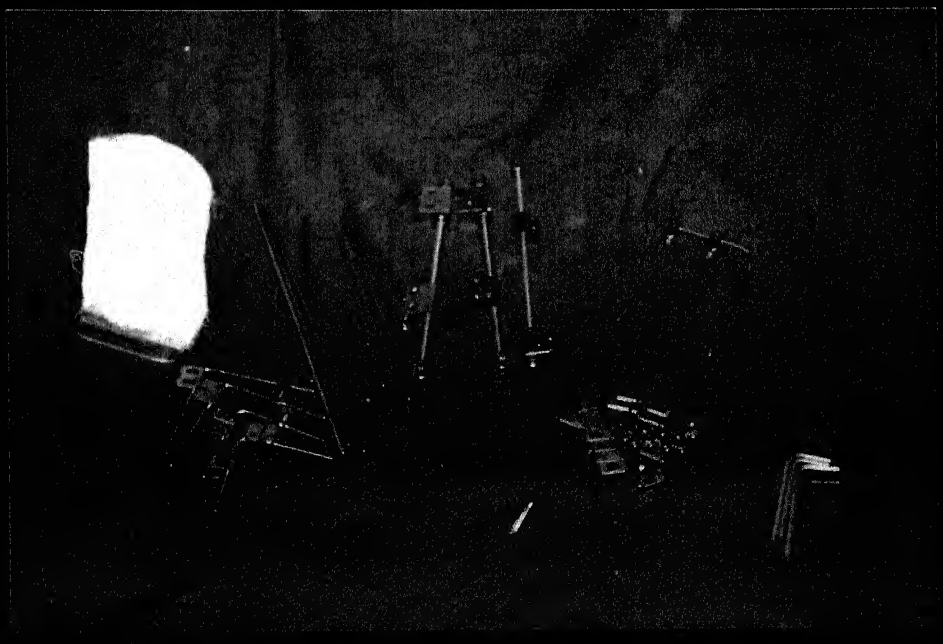
Difference in movement (in°)	Cases	%
10	1	11
20	1	11
30	-	-
40	5	55
50	2	23
60	-	-
Total	9	100

Above table shows that 55% of patients had difference of movements of 40°.

Implants & Instruments



- Hand Drill
- T handle
- Wire cutter
- K wires



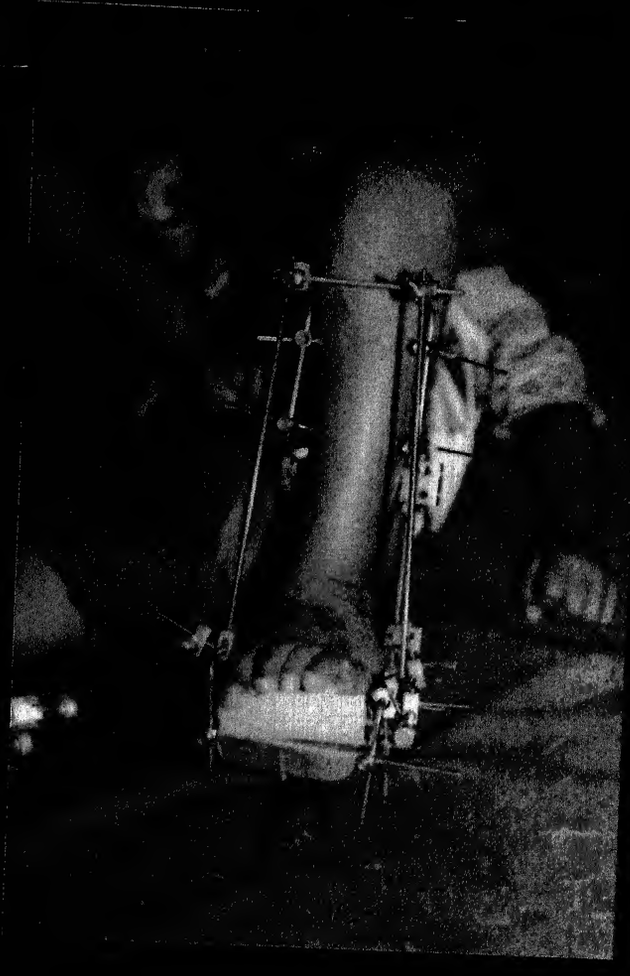
Method of Application.

K wires applied in the foot.

Axial Calcaneal wire [illegible]
the deformity

K wires inserted in the Tibia alo

Foot plate and
Foot distractor
applied.

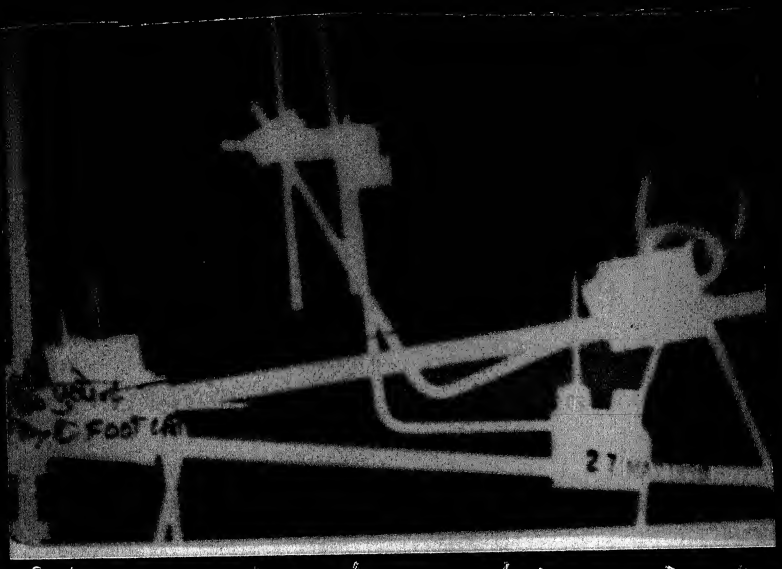


Case no- 1 [PRE OPERATIVE]

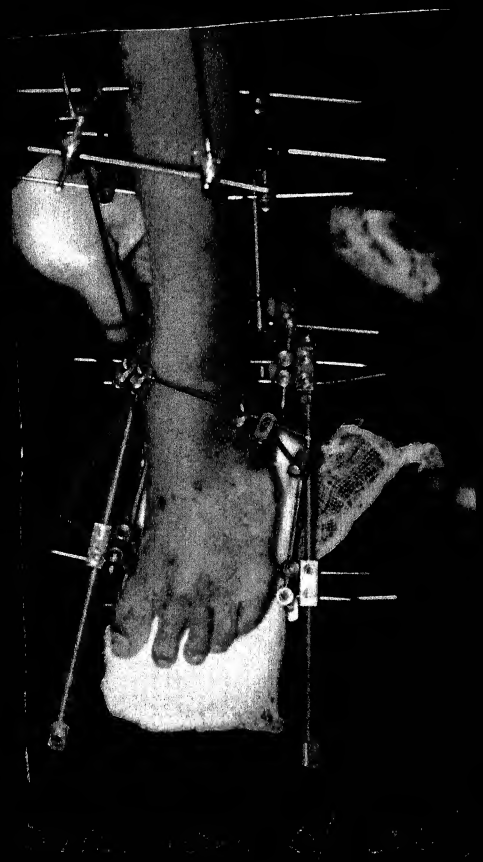
PUSHPENDRA

Bilateral deformity

[POST OPERATIVE]



X ray - Lt foot (Lat view)



Functional Result

On Standing

[PRE OPERATIVE]

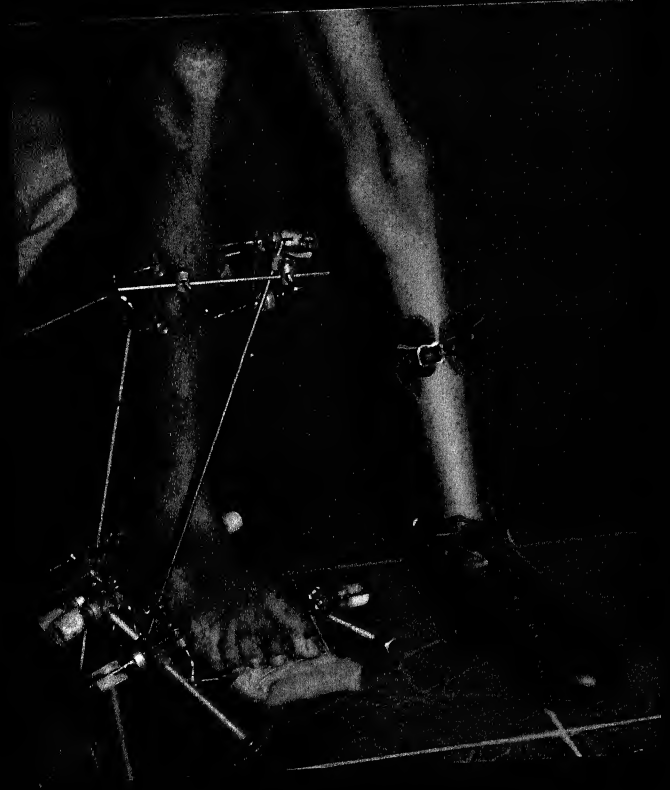
(R) FOOT

Anterior View

Plantar View

[POST OPERATIVE]

(R) FOOT



Correction of deformity

Podogram

Case no - 2

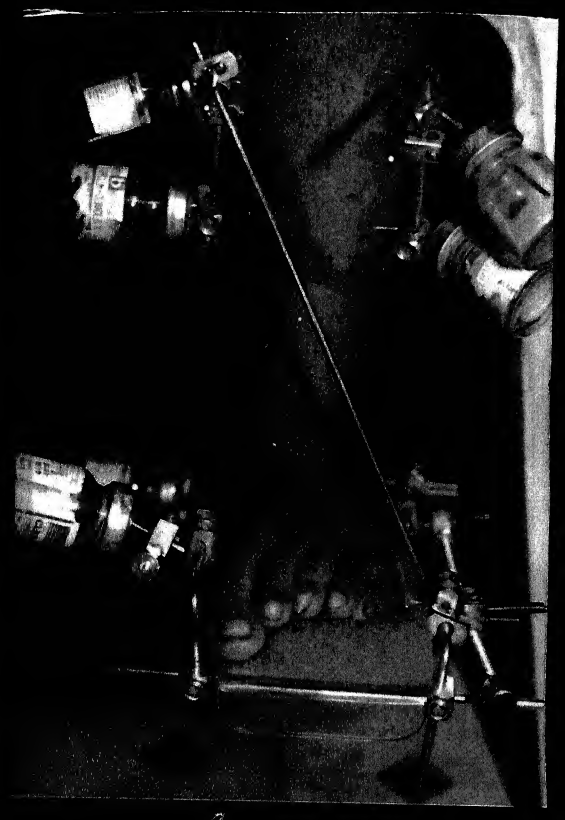
RAJA BABU - (L) FOOT

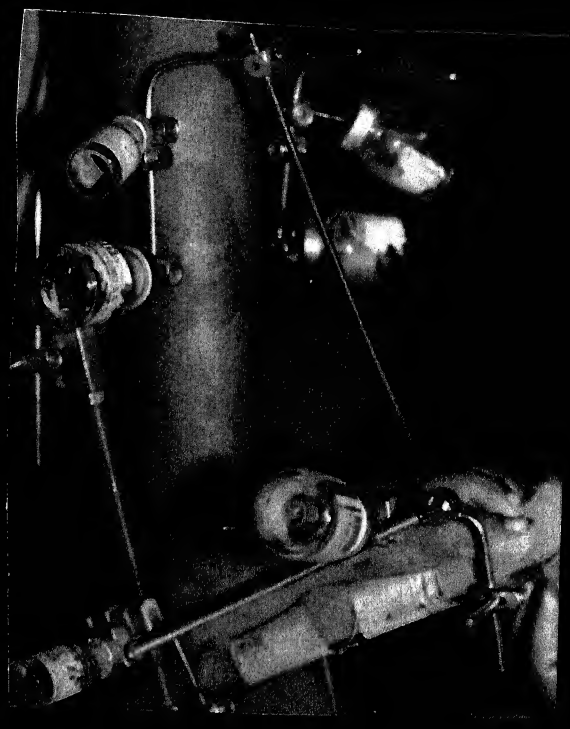
[PRE OPERATIVE]

Plantar view

Lateral view

[POST OPERATIVE]





Correction of Deformity

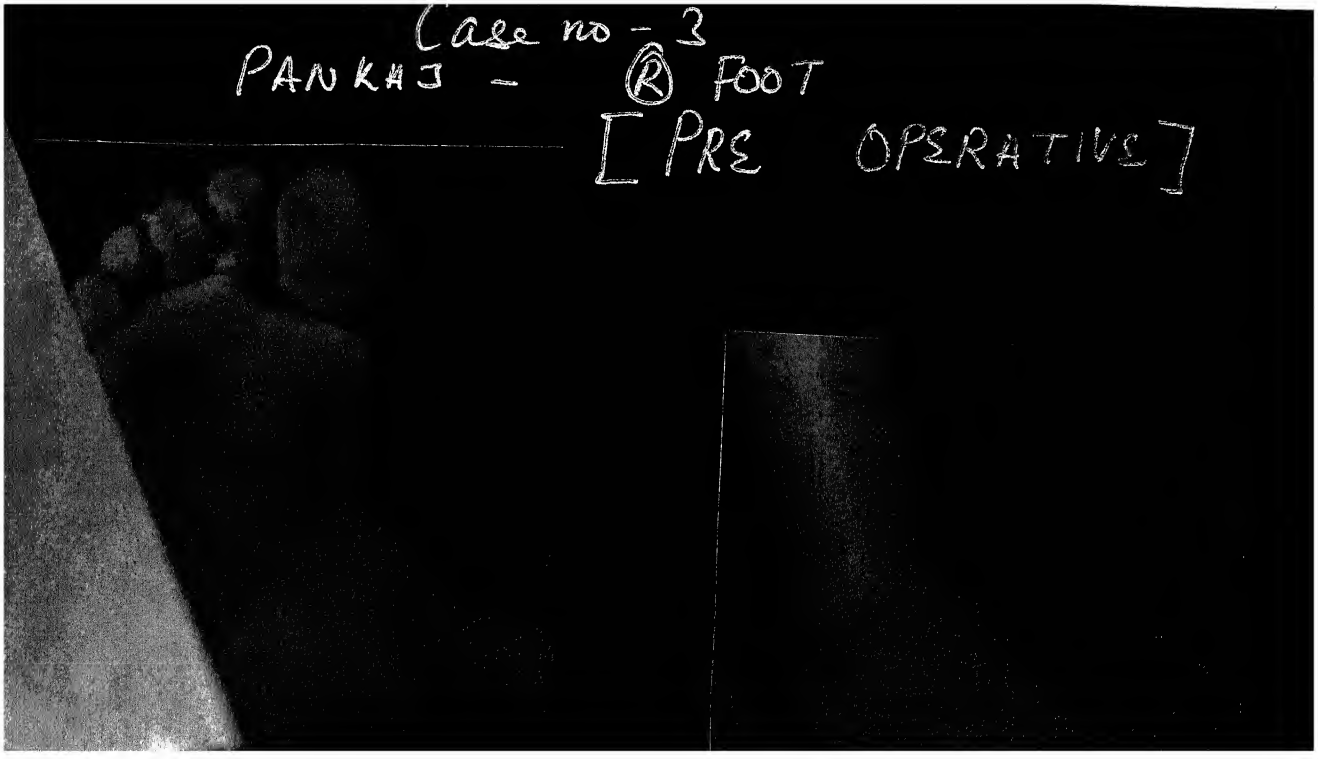
Functional Result

Standing

Case no - 3

PANKAJ - Ⓡ FOOT

[PRE OPERATIVE]



Plantar view

Lateral view

[POST OPERATIVE]

(R) FOOT

Correction of deformity

Casano - 4

DINESH - (R) FOOT

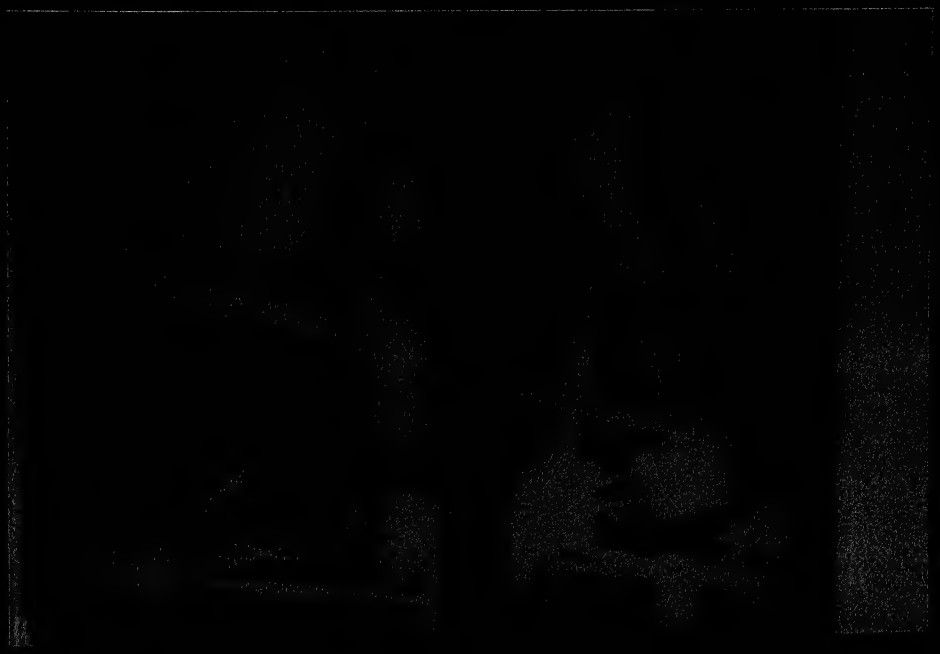
[PRE OPERATIVE]

Plantar view

Lateral view

[PRE OPERATIVE]

Podogram.



[POST OPERATIVE]

(R) FOOT

Correction of deformity

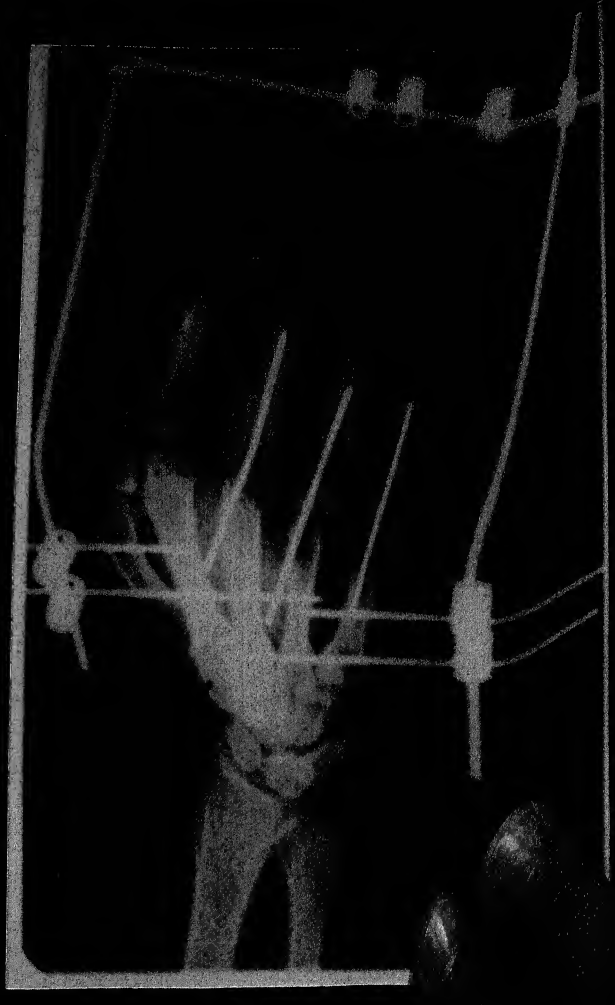
Case no - 5
RAJA BETI - (R) Hand
CRUSH INJURY

Pre Operative Views

Hand frame with [illegible]

Case no — 6
RAJESH - (R) Hand
CRUSH INJURY

Pre operative Xray
AP view



Case no - 7
K.U.Som - ® Middle finger
Volar Dislocation Proximal I.P. Joints

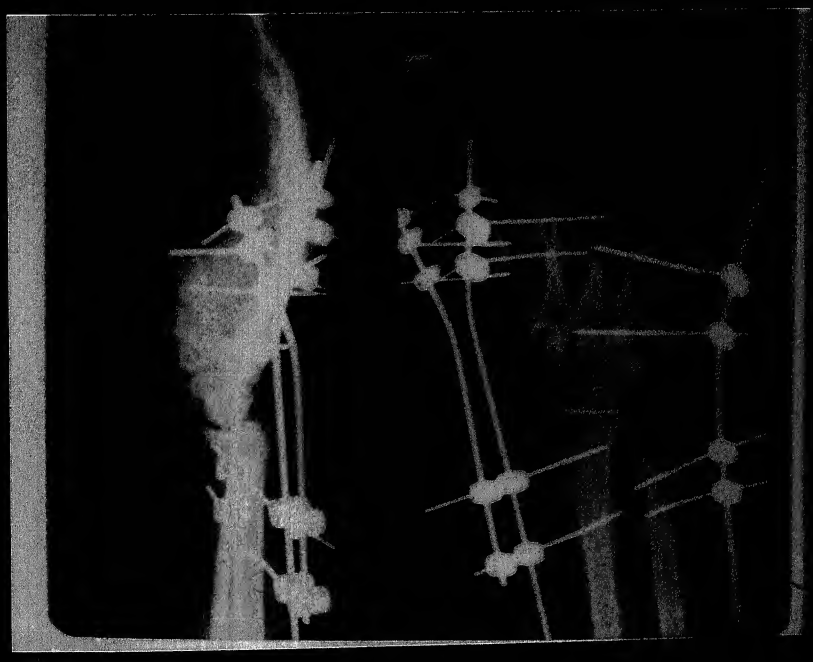
Pre operative AP and Lat views

Case no - 8

PAPPU - (L) THUMB

RUSH INJURY WITH FRACTURE BASE OF 1st METATARSAL

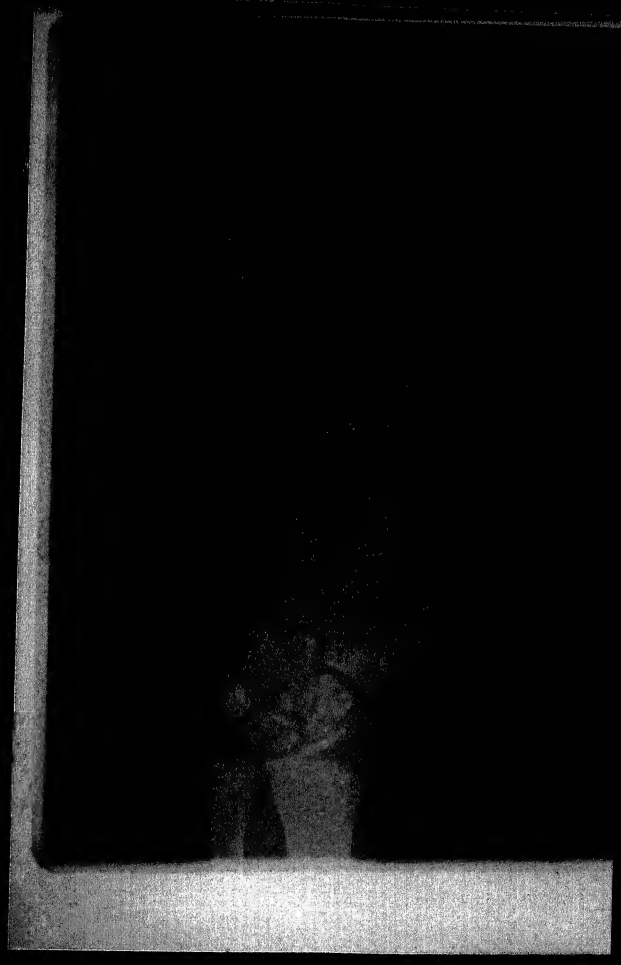
Pre Operative X-ray of the Lateral



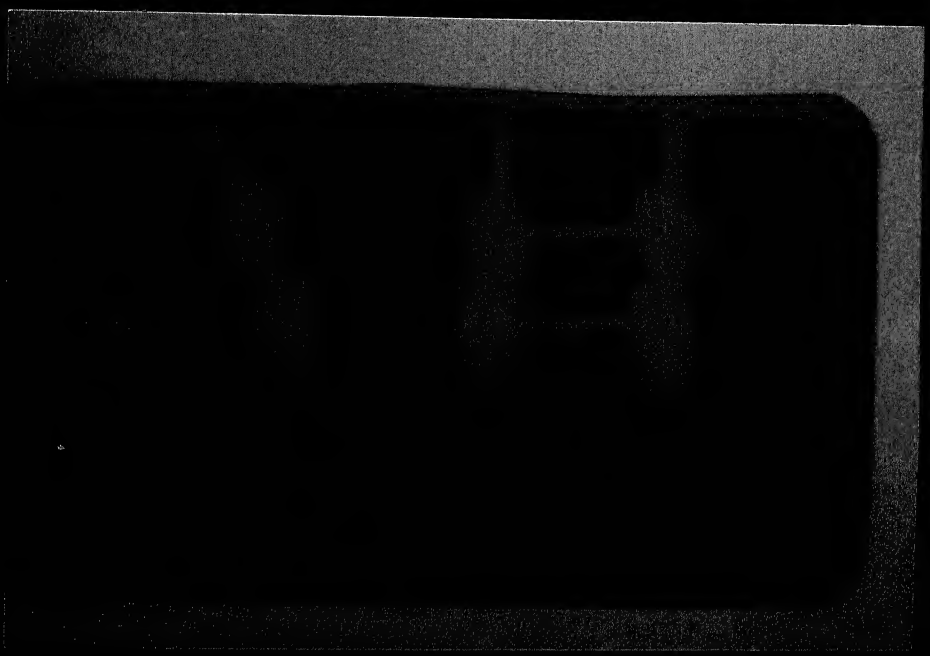
Case no - 9

DHANVANTI - (L) Ring and Little finger Flexion Contracture I.P. Joints

Distraction applied



[POST OPERATIVE]



DISCUSSION & CONSULSION

DISCUSSION & CONCLUSION

Foot deformities of any age are a problem to treat. The deformities produce undesirable morbidity and conventional treatment of these deformities require experience end skill. The end result of such foot in adult result in complete loss of ankle movements. Among the most common congenital deformities of foot is the club foot.

Treatment of congenital talipes equino varus has always been surrounded in controversies. The pathoanatomy of this deformity is complex, the etiology is not known and true disability in a foot is difficult to establish.

The aim of treatment is to obtain a pliable plantigrade and cosmetically acceptable foot

Primary line of Management in correction of CTEV presenting early in life is largely dependent upon non- operative method in the form of gradual and corrective manipulation in casts or splints. (Kite, 1939 and S.A Thompson, 1942). Early months of life offer a golden opportunity for the manipulation and correction of CTEV (Ponseti et al, 1963). Proponents of surgical treatment believe that repeated plaster cast treatment if porlonged causes stiffness and interferes with growth of the foot. (Ponseti 1963, Kite 1939). Another criticism of serial casting is that casts are changed frequently and thus parents must travel long distances. Also effective casting is not a simple procedure as it is difficult to localise bony land marks accurately, through layers of padding and plasters.(J Wedge and H. Allins,1983). Ryoppy (1983) said that it is also difficult to predict the response of any particular patient with CTEV to conservative treatment and months or even years may be lost in the process during which important period of growth and remodelling is lost and possibilities of good results by operation are diminished.

In consideration of above problems and for relapsed or neglected CTEV that rarely respond to non-operative means, various surgical methods have been described.

Incidence of neglected CTEV is much higher in developing countries as compared to developed countries because of poor health care system, poverty

and illiteracy. Patients continue to walk on the lateral border of foot making conditions still worse and their feet become increasingly deformed and rigid.

Neglected and relapsed CTEV have been treated by surgical method varying from posteromedial soft tissue release with or without bony procedures (Comere, 1954 M.Singer 1958, Fried 1961, Allenburough 1966 Garceau 1967 Garland 1969 Turco 1971, Laugh et al 1975, Thompson et al, 1982)

An interesting study of three most commonly performed surgeries for the correction of this deformity came up with unacceptably high propotion of unsatisfactory results.

Long term follow up has revealed the same problems as seen with older procedures such as stiffness of ankle, foot, muscle atrophy, extensive scarring, recurring deformity, in complete correction and over correction are reported.

Prof. Gavrill Abramovich Ilizarov devised. an external ring in 1951 in Russia. Grill and Franke (1987) used the ring fixator devised by Prof. Gavrill Abramovich in correction of deformity in talipes equino varus.A similar study was conducted by Cantil et (1990) the management of severe relapsed congenital talipes equino varus. In all patient treated by ring fixator (except for two cases who developed severe lymphoedema and the treatment was discontinued) a plantigrade foot with satisfactory radiographic appearance was achieved.

Joshi et al,(1990) presented a method of treatment based on use of external fixation devised by him with controlled distraction of soft tissue for realignment of skeleton of foot in talipes equino varus.

In our study eight relapsed and neglected congenital club feet, were treated by Joshi's External stabilizing system, using principle of controlled fractional differential distraction. All patients but one were able to heel walk with valgus heel ,There was a significant increase in foot length the difference in pre operative length between medial and the lateral border being -0.6 while post operative length between medial and lateral border being + 1.6 cm This indicates a gain of 2.2 cm.The medial
border which is smaller than the lateral border in the deformed feet achieved a

near normal relationship with the lateral border after correction.

Functionally the mobility at the ankle joint improved significantly. All cases pre-operatively were fixed is equinus. Pre - operatively the mean dorsiflexion score (according to the joint disease orthopaedic Institute functional rating system for club foot surgery) rates about 14. i.e. ankle dorsiflexion above 90.

Radiologically the Talo calcaneal index mean after correction was 46.5 degree as compared to the mean value of 28 degree before correction. Talo calcaneal angle (AP) mean after correction was 28.5 degrees after correction as compared to 13 degrees before correction similarily Talo Ist metatarsal angle from mean of 30 degreeswas restored to mean of 6.6 degrees.

In a study conducted by Ponseti et al(1990), they compared the radiological results in patients of club feet treated by Kite by serial plaster castings and by Evans who did the conservative treatment followed by surgical repair. They found marked disagreement in the functional and radiological results. As many clinically corrected feet treated by above measures had abnormal anatomical relation ships as observed radiologically.In these studies on an average, only 37% of feet had satisfactory radiological correction in comparison to 74% good functional results in a group of patients. The overall average Talo calcaneal index was 31degree as compared to 46.6 degree in our series. Thus the radiological correction in our series has been better the earlier works.

To comment on complication we have found that out of eight patients two (Raja Babu and Dinesh) had a recurrence of fore foot adduction deformity with their Talo Ist metatarsal angle showing a mean of 13 degrees post operatively. One patients, Dinesh also had heel varus with Talo calcaneal (Ap) view showing 24 degree. These were seen after one year of follow up. Both of then patients did not comply with the post operative protocol. They therefore missed the post operative B/K POP Boot twice and did not turn up for the orthotic shoes. Therefore though this system almost always restores. normalcy, yet post operative management to ensure the maintenance is very important and can not be over emphasised. One patient Pushpendra with Bilateral deformity developed temporary flexion contractures. These flexion contractures were abolished once the frame was realigned under anaesthesia. Realignment of the frame look about 15-20 minutes.

Apart form these complications, the only other were minor one such as supeficial pin tract infections, loosening of link joints, oedema and superficial linear necrosis.

From the above discussion it is evident that it is desirable to have a clinical indicator which could decide whether the foot could be treated conservatively or operatively.This would save much precious time and prevent the accetuation of the deformity.As we know this is not possible at least untill the present time. Here probably this system has its role to play .Since being a semi invasive technique this system may be visualized a process some thing between conservative and operative treatment There for if should tried without wasting any time once conservative treatment appears not delivering the expected results.

We there fore condude that the semi invasive procedure of controlled differantial fractinal distraction for the treatment of club foot deformities is cheap, technically less demanding and an effective procedure for correction of various foot deformities .This procedure not only corrects the deformity but at the same time keeps the joint surface apart there by avoiding any crushing force on bone cartilage. By this process not only the bones but also the muscle, nerve and soft tissue grow simultaneously. Also this being semi invasive procedure it does not require bony and soft resection It corrects the deformity fully, gains foot lenght, improves mobility and streches soft tissue contractures. Also the operating time is about 1 hour as compared to postero medial release whcih takes ahy where between 1.5 to 2.5 hour. In this system Ketamine is used as the aesthetic agent in comparison to postero medial release where muscle relaxants are must for obtaining complete muscle relaxation

Feet corrected by this procedure are plantigrade, mobile, cosmetically acceptable and with better anatomical aligment. In case desired results are not achieved then subsequent procedure in form of soft tissue release or bony procedures are easier to perform leading to desired results.

Hand plays a vital role in a human being in carrying out his profession and daily activities. Deformity in hand may be said to exist at a joint due to dislocation and subluxation, tethering of muscle or tendons or contratures of the soft tissue. Deformity exists in the bone when it is out of its normal anatomical alignment. Of all the causes, fractures and hand injuries are by far the most common cause.

Simple and compound injuries of the hand are challange to the surgeon because stable and accurate fixation of small bones has to be combined with proper drainage,debridement and control of infection with early mobilization of joints, and careful restoration of soft tissue. Rigidly fixing small bones without too much of periosteal stripping, maintainence of length, keeping adjacent joints free, avoidding too much of metal inside are highly demanding constraints into which external fixator makes the best if not the ideal fit. POP immobilization immobilizes extensively and inadequatly. Intra medullary K- wires immobilize too loosely. Plates are cumbersome, increase periosteal stripping and infection , promote bone absorption and fix rigidly only in transverse or short oblique diaphyseal fractures.

Costs and exact time consuming techniques requiring special skill to tailor make operative techinques for the need of the specific case has prevented the popularization of these devices. Nothing is standard, no two operations are alike. On the other hand optimal solutions have to be found and practised. The load of crush injuries, the economic restraint, the limited hospital opportunites and operations time has prompted the evalution of external fixator in our country.

The fixators considered external stabilisation offer the best solution an unstable injuries in the hand. JESS is an external stabilization system quite capable of coping with the distinctive demands of the injured hand.
With the use of thin and smooth wires placed away from the site of injury ,in a stable configuration created by an exoskeleton of connecting system and link joints. JESS provides a stable skeletal environment aiding rapid healing of soft tissues.

Limiting the frame configuration to the involved bone alone allows immediate moblization of the adjacent Joint.Thus restoring circulation and prevents lymph or venous stasis leading to lessor incidence of infections.Since moblization keeps the gliding structures moving,functional restoration is expedient.In the injured hands restoration of skeletal stability would permit a better opportunity to examine and deal with the associated soft tissue injuries. As we all know absolute is detrimental to fracture healing, this system gives stability rather than rigidity to the site of fracture.

When the hand suffers a crushing injury tissues are affected in a variety of

ways. Some tissues are crushed and devitalised,some are severed,yet others are affected by friction or avulsion and some tissues by shear resilience on due to cessation of the crushing force, remain viable. The process and transportation of the patient if done properly minimize the insult. But if this procedure is rough the viable tissue are allowed to kink thus further jeopardising the already precarious blood supply.

On presentation at the hospital rough handling and contact with cleansing chemical irritants like hydrogen peroxide,further damages the hand. Commonly used methods of treatment are stabilization of the fractures with "K" wires and supporting the limb with plaster slab or wire splints or limited internal fixation with plates.

Each of these procedures has inherent difficulties as devitalisation may take place and adequate stability may not be provided.

The JESS extended hand frame offers stabilization by fixation of available intact skeleton without further devitalization. It provides tissues a breathing time and allows revascularsation of the tissue at the cellular level. The simplicity of the procedure, the immense versatality and the possibility of readjustment at a subsequent date confers in this system the unique possibility of achieving good results even in average hands.

So in our series of nine cases of JESS fixator were applied. Maximum population was above the age of thirty five years.

Mode of injury in our cases were mainly fall of heavy objects. Most of the patients presented within 15th day of the injury presentation. In cases of crush injuries wound debridement was done earliest possible before applying fixator.

We dealt with one case of volar dislocation of proximal interphalangeal joint of middle finger two weeks old. We could achieve the reduction beautifully but moderate amount of terminal restrain of movement in flexion was present. One case (Dhanvanti) had flexion contrature at the proximal and distal interphalangeal due to old chronic osteomyleitis. Cosmetic correction was possible although functional end result could not be restored to normal.

The most common type of assembly used in our series were basic hand frame and extended hand frame.

Majorityof our fixator were removed with in 45 days. Two cases had their fixator for about two months with gradual removal of assembly before the final removal.

Most common compilcation observed at the time of fixator removal was presence of deformity due to restriction of movements. Pin tract infection was seen in two cases. One patient had delayed union. We evaluated the movements of different small joints at the time of fixator removal at four weeks and later at six weeks. Most of the movements were severely restricted at the time of removal of fixator. The problem was dealt with active and passive physiotherapy.

At the final follow up about 56% of metacarpo-phalangeal joint had difference of movements of over twenty degrees. One case had difference of movements of eighty degrees.

Recovery of movements of proximal interphalangel joint is poorer as compared to metacarpo-phalangeal joint. 55% of the patients had difference in movements of about 40°.
In distal interphalangel joint about 56% of the patients had difference of movements of about 20° from the normal.

Thus it was observed that the joint stiffness was of severe grade after removal of fixator which gradually improved in few cases up to the final follow up. After evaluating the final results of movements we reached to conclusion that like any other system this system is also not with out fallacy. The major draw back of this system is the stiffness. After three weeks of fixator application the joints in their functional position become very stiff. This is specifically true for the metacarpo-phalangeal joints and the proximal interphalangeal joints of third and fourth finger.

In the comminuted periarticular fractures of the metacarpo-phalangeal joints of third, fourth finger, It becomes quite difficult to perform ligamentotaxis with the help of distracters. This is also true that absence of proper flouroscopic facility and inexperience of the surgeon also make the end result unsatisfactory.

Thus from the over all study conducted by us,we conclude that JESS is a simple, versatile light fixator with a vast modularity and with tremendous potential. It is a very good system for web space maintenance especially the first web space. It is also very effective in reducing fresh as well as old neglected dislocations of hand joints since soft tissue trauma is negligible. It is also very effective in providing soft tissue stabilization in severe crush injuries of the hand. This makes soft tissue handling easier and more physiological. In these injuries on a later date split skin grafts and flaps can be performed and maintained. In comminuted fracture of the base of metacarpals, periarticular fracture around interphalangeal joints, maintenance of bone length, better stabilization of bone segments and better cosmetic results can be expected from this system.

In cases of bone loss better maintenance of length was achieved. The patient's hand is immobilized in functional position so chances of stiffness in non - functional position is much less as compared to immobilization in a plaster of paris slab.

This system also helps in regular cleaning and dressing of wounds much easily and without disturbing the stability of the bony architecture as compared to plaster of paris slab, which are to be removed again and again prior to dressing.

As with any other system we posed few problems with this one. Firstly there is a good amount of difficulty in inserting a K-wire, especially in a metacarpal by a hand drill. This problem becomes manyfolds if this fixator is being applied by an inexperienced person in a grossly crushed hand. Being a procedure using K-wire chances of pin tract infection, tethering of tendons and soft tissues are very much possible. If the frame construction is loose as it quite,commonly happens due to loosening of the link joints malunions of the small bones may occur. This may lead to a deformed hand.

All said and done, with the experience of our studies we found that this system has a long learning curve. If applied properly and judiciously and with the expertise it is of great value in salvaging and restoring hand functions.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Ashmead D41h : Rothkopf D.M., Walton R.L.; Jupitor J.B. Treatment of hand injuries by external fixation. J. Hand Surgery (AM) ;1992 September : 17 (5) : P 954-64.

2. Asche G : The use of mini-fixator in the hand. In mears D.C. External skeletal fixation. Balatomore Williams and Wilkins 1985 : PP505 - 520.

3. Aron J.D. Using methyl methacrylate to make external fixator spint. J.Bone joint surgery 58 A : 151, 19.

4. Bilos. Z.J. and Eskestrand. T. External fixator use in comminuted gunshot fractures of the proximal phalanx. J. Hand surgery 4 : 357 1979.

5. Bogeskov. S. Conservative therapy for fractures of the phalanges and metacarpals act. chir. scand. 133: 123, 1967.

6. Browne Denis Talipes Equino varus Lancet 1, 969.1984.

7. Brown T. Llyod the treatment of clubfoot. The journal of bone and joint Surgery Vol.28 No. 1986.

8. Crawford. G.P. : Screw fixation for certain fractures of the phalngeal and metacarpal bones J. Bone Joint Surgery 58 A: 487, 1976.

9. Cooney W.P. External minifixator : Clinical application and techniques.

10. Crokett. D.J. Rigid Fixation of bones of the hand using 'K' wirs bonded with acrylic resin. Hand 6, 106. 1974

11. Dickson. R.A. Rigid fixation of unstable metacarpal fractures using transverse 'K' wire bonded with acrylic resin. Hand 7 : 24, 1975.

12. Fracture and joint injuries of Hand, R Chrotic Kirays Journal of Plastic Surgery Vol. 7 Part 1.

13. Freeland A.E. : External fixation for skeletal stabilization of severe open fractures of the hand Clinical-orthopaedics :1987 Jan (214) : P 93 -100.

14. Grill, F and Franke J. The Ilizarov distractor for correction of Relapsed & Neglected Club foot JBJS - 69 B (593 - 597) 1987.

15. Garceau G.J. (1940) : Anterior tibial tendon transposition in recurrent congenital club foot. J.B. J.S.,22 932.

16. Garceau G.J. (1947) : Transposition of anterior tibial tendon in the treatment of congenital club foot. J.B.J.S. 22,932.

17. Garceau G.J., Palmer R.M. : Transfer of the anterior tibial tendon for recurrent club foot J.B.J.S. Vol. 49-A, No.2, March 1967.

18. Grundort A.B. Intramedullary fixation for fracture of the hand. J. Hand. Surgery. 6 : 568, 1981.

19. Ikeda Kiyoshi Conservative treatment of Idiopathic. Club foot Journal of Paediatric orthopaedics Vol.12 No.2, 1992.

20. Joshi B.B.; Laud NS, Sudhir Warrier - Basic Techinques of JESS system.

21. Joshi Brij Bhusan, Laud N.S., Kaushik, S.S. Warrier (1990) Manual on controlled differential fractional distraction for correction of Taipes Equinovarus.

22. Joshi, N.S. Laud S.S. Warrier- Operative Manual of Treatment of CTEV by JESS (1992).

23. Joshi, N.S. Laud 1990 : controlled differential distraction for correction of complex CTEV. International conference of club foot.

24. Kite J.H. : Non operative treatment of congenital club foot. Southern Med. J. xxiii, 337, 1930.

25. Kite J.H. : Principles involved in the treatment of congenital club foot. J.B.J.S.

vol. xxi, No.3.July 1939

26. Kite J. H. : Treatment of club foot by casts. J.B.J.S., vol 45 - A, No.2, March1963.

27. Kite J.H. Conservative treatment of resistant club foot (Clinical Orthopaedics) 70 :93 - 110, 1970.

28. Lan Z.U. Use of external fixator in the management of hand injuries 1987, Nov. 58 (11) ; P 712 -7.

29. Marg G: Gautiere E ; Specific utilization potential of the external fixator in severe complex hand injuries.

30. Mckay D.W. New concept and approach to club foot treatment. Section I- Principles and Morbid Anatomy Journal of Paediatrics orthopaedics-2, 347-356 1982.

31. Mckay D.W. New concept of and approach to club foot treatment ; section II - correction of club foot ; Journal of Paediatrics orthopaedics -3, 10 - 21,1983.

32. Mckay D.W. : New concept of and approach to club foot treatment; section III - Evaluation and results ; Journal of Paediatrics Othopaedics 3, 141 - 148, 1983.

33. Mckay D.W. Concept and approach to club foot treatment Journal of Paediatrics Orthopaedics 1983,3, 148-153.

34. Nonnenmacher J: Osteosynthesis of fracture of the base of the first metacarpal by an external fixator Ann Chir Main 2 ; 250. 1985.

35. Ponseti I.VSmoley E.N.: Congenital Club foot, results of treatment ; J.B.J.S. vol. 45-A, No. 2, March 1963.

36. Ponseti I.V. : Treatment of Congenital club foot J.B.J.S., 74-A, No.3, 1992.

37. Porter R.W.: Congenital talipes equino varus resolving and resistant deformities J.B.J.S. vol. 69 - B, No. 5, Nov.1987.

38. Peimer C.A. Smith R.J. and Leffert R.D. Distraction and fixation in the primary treatment of metacarpal bone loss. J. Hand Surgery 6 : 111, 1981.

39. Pritsch. M. Engel J. and Farin. I. Manipulation and external fixation of metacarpal fractures. J. Bone Joint surgery 63 A 1289,1981.

40. Pollack H.J. External fixation in hand surgery Jentralblhir : 1989 :14 (6) P 404-9.

41. Putnam M.D. Seitz W.H. (Jr). Advances in the fracture management in the hand and distal radius : hand - clin. 1989 August : 5 (3) P 455 - 70.

42. Parson S.W., Fitzgerald JA: Shearer JR : External fixation of unstable metacarpal and phalangeal fractures. J. Hand - Surgery (Br.) : 1992 April : 17 (2) : P - 157 -5.

43. Riggus SA. Coney In. P External fixation of complex hand and wrist fractures J. Trauma 1983 : 2 : 332 -6.

44 Ryoppy S, Sairanen H. : Neonetal Operative treatment of club foot J.B.J.S., vol. 65-B No.3, May 1983.

45. Shehaide SL. External fixation of metacarpal and phalangeal fractures J. Hand Surgery (Am) : 1991 May : 16 (3) P 544 -50.

46. Schuind F : Donker Wolcke M: Burney F. External minifixation for treatment of closed fractures of the metacarpal bones J. Orthopaedic trauma : 1991 : 5 (2) : P 146-52.

47. Segmuller G ; Surgical stabilization of the skeleton of the hand. Baltimore ; Williams & Wilkins 1977 : 42 - 59.

48. Seitz Kih (Jr). Gomez W. Putnam MD : Rosen Wasser MP: Management of

severe hand trauma with mini external fixator Orthopaedics 1987 April : 10 (4) P601-10.

49. Smith R.S. Alonso J: Horonitzm ; External fixation of open comminuted fractures of the proximal phalanx orthopaedics REu :1987 December 16 (12) P 937 -4.

50. Simons W. George : Complete subtalar release in club foot. Part I -A preliminary report. J.B.J.S., vol. 67 -A, No. 7 1985.

51. Simons W. George : Complete subtalar release in club foot part II- compairson with less extensive procedure. J.B.J.S., vol. 67 -A, No. 7, 1985

52. Singer M, Al Fripp : Tibialis anterior tendon transfer in congerital club foot. J.B.J.S., vol - 40 - B, 252, 1958

53. Singer M, : Tibialis posterior tendon transfer in congenital club foot. J.B.J.S., vol - 43 - B, No. 4, Nov. 1961.

54. Tachdian M.O. : Pediatric Orthopaedics Phildephes 1990 : 2428 - 557, (57) Tarraf N. Corroll C. Analysis of components of residual deformity in club foot presenting for re-operation. Journal of Paediatric Orthopaedics, vol. 12, No.2,1992.

55. Turco V.J. : Surgical correction of resistant club foot. One stage posteromedial release with internal fixation. A preliminary report. J.B.J.S. (Am) 1971, 53-A, 477 -97.

56. Turco V.J. Resistent club foot one stage Postereomedial release with internal fixation a follow up report of a fifteen year experience JBJS (AM) 1979 61-A, 805-14.

57. Vidal. J. Introduction to external fixation In mears. D.C.(ed) External skeletal fixation Baltimore Williams and Wilkins 1983. PP 1-13.

58. Vomasaal. F.M. Intramedullary fixation in fractures of the hand and fingers.

59. Wright T.A. : Early mobilization in the fractures of the metacarpal and phalanges. Can. J. Surgery 11 : 491, 1968.

60. Wexlor Mr. , Roussom.Weinberg. H : Arthrodesis of Finger Joint by Dynamic external compression. Plast reconstr. Surgery 1977 : 59 :8.

MASTER CHART FOR CLUB FOOT

Sr.No. Name	Age (yrs.)	Sex	Side	Type Idio (I) Myo (M) Neuro (N)	Callosity	Distraction Phase (wks)	Static Phase (wks)	Removal Time (wks)	Pre Operative						Post Operative								Complication					Pd. of Hospitalisation(wks)	Post op.Hospitalisation(wks)
									Medial Border (cm.)	Lateral Border (cm.)	T.C.A. (A.P.) in °	T.C.A. (Lat.) in °	T.C.I. in °	T.M.A. in °	Medial Border (cm.)	Lateral Border (cm.)	T.C.A. (A.P.) in °	T.C.A. (Lat.) in °	T.C.I. in °	T.M.A. in °	Position of Heel VI,Va,N	Forefoot app. Add,Abd,N	Pin Tract Inf	Linear Skin Necrosis	Oedema	Link Joint Loosening	Flexion Contracture		
1. Raja Babu	4	M	L	I	+	5	6	11	7.8	8.1	15	12	27	18	13.5	11.7	27	20	47	15	VI	Add	+	-	-	++	-	8	9
2. Arti	8m	F	R	I	-	5	5	10	7.8	8.2	17	15	32	22	10.7	9.5	28	27	55	2	N	N	+	+	+	+	-	13	11
3. Dinesh	3	M	R	I	+	4	6	10	7.5	7.8	14	10	24	32	11.7	10.6	24	20	44	12	Va	Add	+	-	+	++	-	12	11
4. Pankaj	4	M	R	I	-	6	6	12	11.0	11.5	22	12	34	35	14.7	14.0	34	22	56	3	VI	N	-	-	-	+	-	6	5
5. Pushpendra	8	M																											
A			R	I	+	14	6	20	7.6	8.5	12	15	27	38	16.2	14.3	30	32	62	3	VI	N	-	-	-	+	+	6	5
B			L	I	+	10	6	16	7.5	9.5	14	11	25	34	15.5	14.2	28	25	53	5	VI	N	-	-	-	+	+	5	4
6. Zishan	4	M	R	I	-	4	6	10	8.4	8.8	16	13	29	29	11.9	11.0	30	28	58	6	VI	N	+	-	-	+	-	5	5
7. Laxmi	3	F	R	I	-	5	6	11	9	9.5	10	12	22	28	12.1	11.4	26	24	50	2	VI	N	-	-	-	+	-	6	4
8. C.Mohan	3	M	R	I	-	5	6	11	9.5	10	10	14	24	32	11.1	10.4	24	22	46	8	VI	N	-	-	+	+	-	4	3

MASTER CHART FOR HAND INJURIES

Sr.No.	Name	Age (yrs.)	Sex	Mode of Injury	Simple / Compound	Duration of Injury(wks)	Rays Involved	Joints Involved				Frature Site				Jess Frame	Post - Opretavily Movements					Complication				Pd. of Hospitalisation(wks)	Post op.Hospitalisation(wks)
								CMC	MP	PIP	DIP	M	PP	MP	DP		MP (in °)	PIP (in °)	DIP (in °)	CMC (in °)	PT.	Oedema	Skin Neeroses	Loosening of Joints	Pain		
1.	Raju	18	M	Thresher	Open	Odays	R 2,3,4	+	+	-	-	2-5	3,4	-	-	Hand Frame	40°	20°	N	N	-	P	-	+	+	8	6
2.	Dhanvanti	10	F	Old Deformity	Open	2yrs.	L 4,5	-	-	+	4,5	-	-	-	-	DISTRACTORS	-	-	-	-	+	+	-	-	-	2	2
3.	KUSUM	35	F	Dislocation Volar	Simple	2Wks.	R 2	-	-	3	-	-	-	-	-	DISTRACTORS	-	40°	-	-	+	+	-	-	-	1	1
4.	PAPPU	32	M	Thresher	OPEN	3days	L 1	+	1	-	-	1	-	-	-	Thumb Ray Frame	60°	-	-	-	+	+	-	+	-	2	1
5.	POONAM	18	F	Glass Injury	OPEN	2days	-	-	-	-	-	-	-	-	-	Thumb Web Maintinance	-	-	-	-	-	-	-	-	-	3	3
6.	RAJA BETI	35	F	Crush Injury	OPEN	2days	R2,34,5	-	+	+	+	2-5	3	-	-	Hand Frame with Distractors	70°	40°	-	-	-	+	-	+	+	5	4
7.	RAJESH	40	M	Crush Injury	OPEN	0days	R3,4,5	-	+	+	-	-	3-5	-	-	Extended Hand Frame	-	50°	-	-	-	+	-	-	-	15 days	15 days
8.	R.KUMAR	42	M	Crush Injury	OPEN	1days	R2,3,4	-	-	-	-	-	2-5	-	-	Hand Frame	40°	10°	10°	N	-	-	-	-	-	5	4
9.	HABIBUR	36	M	Thresher	OPEN	0days	L 2,3,4,5 R2,3,4	+	-	-	3,4	2-4	2-4	2-4	-	Extended Hand Frame	20°	10°	10°	10°	-	-	-	-	+	6	6